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FACTORS AFFECTING INSTITUTIONAL PERFORMANCE AT HIGH AND VERY HIGH RESEARCH UNIVERSITIES: POLICY IMPLICATIONS

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VERY HIGH RESEARCH UNIVERSITIES: POLICY IMPLICATIONS

A dissertation submitted in partial fulfillments of the requirements for the degree
of Doctor of Philosophy at Virginia Commonwealth University.

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Abstract

FACTORS AFFECTING INSTITUTIONAL PERFORMANCE AT HIGH AND VERY HIGH RESEARCH UNIVERSITIES: POLICY IMPLICATIONS

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A dissertation submitted in partial fulfillments of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

Virginia Commonwealth University, 2016

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Higher education institutions in the United States (U.S.) are under stress. Universities and colleges in the U.S. face competing demands marked by steeply declining state and local appropriations and increased competition for research dollars and prestige. This stress is felt most acutely at high and very high research universities who must face these funding challenges while at the same time must serve a multiplicity of missions and stakeholders.

This study examines factors that influence institutional performance at high and very high research universities in the U.S. These high and very high research universities, as classified by the Carnegie Foundation for the Advancement of Teaching under the 2010 Basic Classifications, represent doctorate granting institutions with the highest levels of research activity. Drawing from systems theory and neoliberalism, the study employs a non-experimental quantitative research design using secondary analysis of data collected primarily through the U.S. Department of Education's Integrated

Postsecondary Education Data System (IPEDS), the Association of University Technology Managers (AUTM), and the Carnegie Foundation for the Advancement of Teaching. The data was analyzed for the years 2008 through 2012.

Given a competitive environment marked by decreasing resources, the findings suggest that universities, whether public or private, will continue to pursue strategies and policies that will favor entrepreneurial activities with clear revenue implications as well as attracting top students in an effort to increase institutional performance. The need for further research into institutional factors and performance models is identified as well as the need for comprehensive institutional data. The concept of policy alignment is introduced as a way to cope with demands at all levels of policy.

To the extent that high and very high research universities continue to face a competitive environment with decreasing state and federal resources, greater understanding of institutional factors that can impact revenues will become important as competition for revenues increase. Performance models such as the one explored in this study can help universities, policy makers, and stakeholders make decisions and set policies that can bolster the institutions' activities given environmental challenges.

CHAPTER I

INTRODUCTION AND STUDY OVERVIEW

Higher education institutions in the United States (U.S.) are under stress. Universities and colleges in the U.S. face competing demands marked by steeply declining state and local appropriations and increased competition for research dollars (National Science Foundation, 2014a). This stress is felt most acutely at high and very high research universities who must face these funding challenges while at the same time must serve a multiplicity of missions and stakeholders.

Given the complexities, hyper-competition, and constrained resources active in the higher education environment, this study examines factors that influence institutional performance at high and very high research universities in the U.S. Within the context of this study, performance is defined as the sum, in dollars, of grants and contracts revenue and licensing revenue at these institutions. These high and very high research universities, as classified by the Carnegie Foundation for the Advancement of Teaching under the 2010 Basic Classifications, represent doctorate granting institutions with the highest levels of research activity. Drawing from systems theory and neoliberalism, the study employs a non-experimental quantitative research design using secondary analysis of data collected primarily through the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), the Association of University Technology Managers (AUTM), and the Carnegie Foundation for the

Advancement of Teaching. The data was analyzed for the years 2008 through 2012. To the extent that high and very high research universities continue to face a competitive environment with decreasing state and federal resources, greater understanding of institutional factors that can impact revenues will become important as competition for revenues increase. To this purpose, the analysis in this study seeks to answer the overall research question:

What are significant factors affecting institutional performance at high and very high research universities?

Performance models such as the one explored in this study can help universities, policy makers, and stakeholders make decisions and set policies that can bolster the institutions' activities given environmental challenges. This chapter provides a statement of the problem and the purpose and significance of the study within the current context of higher education in the U.S. This chapter also presents an overview of the dissertation.

Statement of the Problem

At once, the university is called to be an anchor in the community, a place for knowledge creation and dissemination, a place for innovation and economic development, a place for social and workforce development, and finally a place where productive citizens and leaders are prepared for future careers. All at the same time, university actors are expected to strive for the best and be in a way elitist yet "be keenly aware of their responsibilities to society at large, to democratic progress, and to

egalitarianism” (Watson, 2007, p. 2). Likewise, universities are called to be “aggressively entrepreneurial, to understand and exploit their assets,” but at the same time must hold a “profound duty of care to their members” and to “society in general” (p. 2). This complexity of purpose is reflected in the history of the university in the U.S. and in the societal, political and institutional demands that continue to shape their operation.

The problem is these conflicting systemic demands place a high level of stress on higher education institutions (HEIs) that must compete for revenue sources, become more self-sustaining, and must maximize outputs, while at the same time answer questions about their role and value to society. As resources become constrained, the need to understand the relationship between institutional factors and institutional output or performance increases. Within these systemic demands, policies and university factors may affect institutional performance.

Significance of the Study

This study was conducted in order to further understand factors affecting institutional performance, as measured by grants and contracts revenue and licensing revenue, to seek empirical evidence of such factors, and to add to the literature by helping to develop more comprehensive models of university performance as well as to replicate and support previous findings in the literature. This evidence may be used to inform institutional policy decisions as it relates to research and entrepreneurial activities and the role of universities as public policy agents of knowledge creation and dissemination. The development of comprehensive models of institutional performance can also assist stakeholders, policy makers, and leaders, in informed decision-making, policy development, and resource allocation given economic constraints. The following

section provides a brief background to the current state of universities in the U.S. and gives some description of the current environment.

Background

For many years universities in the United States (U.S.) have enjoyed a position of preeminence and prestige. In a recent ranking of 400 universities from around the world, four out of the top five, and seven out of the top ten universities listed were American universities, with California Institute of Technology (Caltech) listed as the number one university in the world (World University Rankings, 2013). This preeminence attracts students, resources and scholars from around the globe. In 2012, international student enrollment increased over seven percent from the previous year and comprised roughly four percent of the U.S. total enrollment of 21.2 million students (Institute of International Education, 2012). This position of preeminence may be showing signs of weakness, however. Among Organisation for Economic Co-operation and Development (OECD) countries, the U.S. ranked 12th in the percentage of 25 to 35 year olds who had attained tertiary or advanced post-secondary education (OECD, 2013). In addition, a recent U.S. Census report showed that after a period of sustained growth, both undergraduate and graduate college enrollment declined in the U.S. in 2012 (U.S. Census Bureau, 2013). At the national level, the state of U.S. higher education and the preeminence of U.S. universities continues to be a topic of discussion among educators, students, policy makers and other stakeholders, especially given challenging economic conditions, limited resources and increased competition. The challenges facing U.S. higher education include structural challenges in terms of declining public support and annual state appropriations, declining federal support for

sponsored and basic research, increased competition from for profit organizations, and a questioning of the purpose and worth of a college education (Kiener, 2013). These challenges place demands on factors at the institutional level and may affect the performance and operation of even the most preeminent universities and colleges.

The State of the U.S. University

Several publications from 2012 shed light on the state of U.S. universities and give an overview of challenges and opportunities facing institutions of higher education.

A Crucible Moment: College Learning and Democracy's Future (The National Task Force on Civic Learning and Democratic Engagement, 2012), *The Current Health and Future Well-Being of the American Research University* (The Research Universities Futures Consortium, 2012), *Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security* (National Research Council, Committee on Research Universities, 2012), and *Diminishing Funding and Rising Expectations: Trends and Challenges for Public Research Universities, A Companion to Science and Engineering Indicators 2012* (National Science Board, 2012), summarize the challenges facing the modern U.S. university with each report giving prescriptions and courses of action to ensure the continued success and dominance of these institutions.

Each report acknowledges shortfalls currently hindering these institutions and makes a case for action and progress to ensure their healthy survival. Whereas the first report acknowledges the loss of civic engagement and concerned citizens (The National Task Force on Civic Learning and Democratic Engagement, 2012), the others describe an environment of hyper and global competition, declining investment and increasing

compliance (The Research Universities Futures Consortium, 2012, National Research Council, 2012, National Science Board, 2012). The reports prescribe actions to address the shortcomings in the system.

Continued investment is required to renew civic engagement, a concerned citizenry and the “nation’s social, intellectual, and civic capital” (The National Task Force on Civic Learning and Democratic Engagement, 2012, p. 2). Higher education institutions (HEIs) are at the center of creating, fostering, learning, and practicing democratic and civic responsibilities. Universities are the location for fostering education for democracy “which needs to be informed by deep engagement with the values of liberty, equality, individual worth, open mindedness, and the willingness to collaborate with people of differing views and backgrounds toward common solutions for the public good” (p. 3). Investments in knowledge, skills, values, and collective action can promote civic learning and democratic engagement. By investing wisely in the educational system, “higher education can ignite a widespread civic renewal in America” (p. 4). The prescriptions in this report apply to higher education in general including research universities.

Continued investment and support is also required to maintain America’s lead in innovation and economic development. Additional financial support is required to sustain the current size and scope of the academic research enterprise (The Research Universities Futures Consortium, 2012). Continued and sustained investment in higher education research is “critically important in the economic health and global competitiveness of the United States” (p. 54). High levels of investment led to the historical expansion and thriving era of higher education in the 1960s and 1970s fueled

by “strong public support” and “the partnership between the federal government to fund the direct cost of research and a portion of the associated infrastructure” and “the states providing funding for facilities, equipment, and faculty” (p. 61). These relationships are now strained by ever decreasing public support and “ever-increasing growth of government regulation and reporting requirements” (p. 32).

Key stakeholders including federal and state government, business and industry, and research universities must stay committed to making the necessary investments to ensure American innovation and competitive advantage and to ensure national security. These necessary investments should include more effective and stable federal funding policies for universities engaged in research and for greater support of graduate education (National Research Council, 2012). There has been a substantial decline over the last decade in per student state appropriations with a concern that the affected public research universities will be unable to continue to provide “affordable, quality education and training to a broad range of students, conduct the basic science and engineering research that leads to innovations, and perform their public service missions” (National Science Board, 2012, p. 2) including contributions to “economic development at the local, state, and national levels” (p. 19).

It is worthwhile to note that all of these reports acknowledge the essential and crucial role universities play in all aspects of society including civic and social engagement, economic development, and innovation. These reports also describe how universities work in close proximity and in partnership (and perhaps sometimes in conflict) with their communities and with other institutions, both public and private. Each report acknowledges the importance of government, public policies and policy makers,

and the importance of complementary work and cooperation between governmental actors and educational institutions. Table 1 summarizes the reports described above and provides key findings and conclusions as they relate to universities and their mission.

Table 1 <i>Reports on Higher Education Institutions (HEIs)</i>	
Report Name	Key Findings and Recommendations
<i>A Crucible Moment: College Learning and Democracy's Future</i> , National Task Force on Civic Learning and Democratic Engagement, 2012	HEIs should: -Foster civic ethos across all parts of campus and educational culture -Make civic literacy a core expectation for all students -Practice civic inquiry across all fields of study -Advance civic action through transformative partnerships at home and abroad.
<i>The Current Health and Future Well-Being of the American Research University</i> , The Research Universities Futures Consortium, 2012	HEIs are challenged by: -Hyper-competition and complexity -Burden of compliance and indirect cost recovery -Access to reliable data on research quality and impact -Access to reliable data for planning and decision support -Relating the value of the research university -Understanding the fragility of the academic research enterprise.
<i>Diminishing Funding and Rising Expectations: Trends and Challenges for Public Research Universities, A Companion to Science and Engineering Indicators 2012</i> , National Science Board, 2012	HEIs continue to experience: -Increased enrollment, declining state support -Increased enrollment projected for underrepresented minority groups -Reductions in revenue at public research universities, gaps in salary between public and private universities, outflow of talent at public research universities, reduced research capacity -Changes in federal subsidized loan program should avoid unintended consequences to undergraduate and graduate education.

Table 1 <i>Reports on Higher Education Institutions (HEIs)</i>	
Report Name	Key Findings and Recommendations
<i>Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security</i> , National Research Council, Committee on Research Universities, 2012	<p>HEIs can benefit from:</p> <ul style="list-style-type: none"> -Stable and effective federal policies, practices, and funding for R&D and graduate education -Greater autonomy for public research universities, restoration of state appropriations to operate at world-class levels -Facilitating the transfer of knowledge, ideas, and technology to society, accelerate “time to innovation” -Increase in cost-effectiveness and productivity, a greater return on investment for sponsors and other stakeholders -A “Strategic Investment Program” that funds initiatives to advance education and research in areas of key national priority -Receipt of full costs of research and other activities procured by the Federal Government and other research sponsors -Reduction or elimination of regulations that increase administrative costs, impede research productivity, and deflect creative energy -Improving capacity of graduate programs to attract talented students by addressing attrition rates, time to degree, funding, and alignment with both student career opportunities and national interests -Securing full benefits of education for all Americans, in science, mathematics, engineering, and technology -Ensuring the U.S. will continue to benefit strongly from the participation of international students and scholars in the research enterprise.

Overview

Chapter II below further explores relevant literature on the state of research universities and relevant policies and practice at the national, state and institutional level, as well as competitive forces affecting institutional factors and missions. Chapter II also describes the theoretical framework, which guided this study.

Chapter III focuses on the methods used in this study, i.e. secondary analysis of national data sets using multivariate hierarchical regression, to address the overarching research question stated above as well as five underlying research questions:

- Do universities with a larger number of tenured or tenure track faculty perform at a higher level?
- Does student selectivity of the university affect level of performance?
- Do private (non-profit) universities, by virtue of their financial, non-public status, perform at a higher level when compared to public universities?
- Do universities classified as “community engaged” by Carnegie Foundation perform at a higher level than universities not classified as “community engaged”?
- Do universities with higher patent application activity perform at a higher level?

Chapter IV then presents the results of the data analysis including related hypotheses testing. Finally, Chapter V provides a summary of the study as well as further interpretation of the data results in relation to the framework and literature reviewed. Chapter V also discusses the policy implications of the findings, limitations of the study, conclusions, and suggestions for future research in the topic area.

Understanding key factors of productivity at research universities can inform policies at the institutional level as well as the state and national level. From an institutional perspective, policies shape the operation and function of the university. Institutional policies, incentives and practices regarding research, teaching and service activities, for example, may shape the makeup, focus and work of faculty at the institution. Likewise, the size and makeup of the student body may affect the extent to which faculty are engaged in research activities. Federal policies, agency focus and funding available for research projects and contracts may affect the extent to which

universities operate and produce knowledge. Universities are agents of these policies that can advance or hinder the university mission.

CHAPTER II

LITERATURE REVIEW

This chapter reviews literature related to the current state of higher education in the U.S. and also literature that describes particular factors that can be associated with institutional performance at U.S. research universities, particularly those with high and very high research productivity. Relevant search terms used to derive literature for this review include - U.S. higher education, economic development, regional development, entrepreneurial universities, universities and innovation, university engagement, research output, and university mission. These terms and themes are relevant to this study because they help explain or describe the relationships between elements in the research questions, the function and purpose of the universities studied, and help describe how and why universities act as institutions given environmental pressures and relevant policies. In addition, these themes frame the research questions based on ongoing pressures and challenges currently being faced by U.S. universities. Some of these pressures and challenges were described previously in the introduction (see Table 1 for highlights).

Specific topics addressed in the sections below include - universities and their role as agents in society given historic and influential policy, universities and their specific role as agents of engagement, community and economic development, and, finally, relevant factors and models for measuring institutional output. The selected

literature helps identify the roles of the university and how the performance of those roles is identified, measured, and evaluated.

The University as Agent in Society

The modern university is increasingly expected to do more and be more in both form and function, in many instances with conflicting pressures (Watson, 2007). The notion that the modern university is an isolated ivory tower is lost when considering the close relationship many of these institutions have with their surrounding communities. Universities play the role of anchor institutions in their communities by acting as partners in social and economic development, capacity building and neighborhood rehabilitation (Hodges & Dubb, 2012). This indispensable role of universities as agents of community and economic development is manifest not only in the U.S. but also in Europe, the Middle East, and other developing nations (Trani & Holsworth, 2010). The term “agent” befits universities (Hansen & Lehmann, 2006; Peer & Stoeglehner, 2013; Weinberg, 2002) as they take an active role in producing a specified effect acting on behalf of, with, and for their communities. Colleges and universities have been acting as agents for and with their communities since the early beginning.

Since the days of the early U.S. colonies and the beginning of Harvard College in 1636, U.S. institutions of higher learning have been serving the public and have helped to shape society and the growing nation. Despite the notion that early colleges were aristocratic in nature, these colleges served society’s need for training and developing schoolmasters, clergy and early public servants and civic leaders. The colonial era colleges were established perhaps because of old traditions and institutions, but the early colleges also served the public good by training future leaders, the clergy and

lettered people (Rudolph, 1990). The college was made to help society mold the future by training the men who would make the “difference between civilization and barbarism” (p. 6). From early on, colleges and universities have addressed the needs of society and have also served as public policy agents, carrying out policies and programs set by legislation.

Policies with Historical Impact

Although education in the U.S. is primarily a state and local responsibility, the Federal government has been influential in shaping education at all levels through enacted legislation (“Federal Role in Education,” 2013). Along with local and state policy, national legislation has shaped American higher education since the early days of Harvard College and continues to shape the present landscape. There is a long list of legislation that continues to evolve given the needs of a changing society; the Health Care and Education Reconciliation Act of 2010, for example, contained a provision that reformed and changed the way student college loans are administered and distributed (“Digest of Education Statistics,” 2011). The influence and forces at play can shape legislation and public policy with dramatic consequences. The Morrill Land Grant Act of 1862 and 1890 and the Bayh-Dole Act of 1980 are just two examples of highly influential legislation, with far reaching impact and consequences. More recently, a sizable portion of the funds appropriated under the American Recovery and Reinvestment Act (ARRA) of 2009 was distributed through government agencies to colleges and universities for research and development and science related activities. As with much of this legislation, higher education institutions stand as the agents of its implementation, development and success.

Morrill Land Grant Act. The Morrill Land Grant Act of 1862 is an example of legislation that expanded the role of universities and provided increased access to higher education in its implementation. This landmark piece of legislation was long in developing and was shaped by societal pressures dating back to the American Revolution (Duemer, 2007). The Act was named after its chief sponsor, Vermont Representative Justin S. Morrill, whose experience and thought supported “a more practical education for working class families” (Cross, 1999, p. 78). The Morrill Land Grant Act provided land and as a result funding to states to establish and support universities in an effort to provide training in these expanding fields. Morrill’s legislation also provided increased public access to higher education by opening the doors to farmers and others who lacked the means to attend college (Duemer, 2007, p. 136). Through this legislation, universities were able to bring education to greater numbers and to address society’s changing needs. The Morrill Land Grant Act “stands out as path breaking legislation that signaled the entrance of the federal government into public policy dealing with creation of the land-grant colleges” (Thelin, 2011, p. 74).

The Morrill Act further changed the role of universities by increasing access through federal and state support of higher education. This support allowed the liberal and practical education of the industrial classes in the development and pursuit of scientific knowledge, farming and practical sciences. The continued expansion of university programs, to include numerous and diverse courses of study, graduate degrees and commitment to public service, were exemplified by the rise and prominence of the state university (Rudolph, 1990). The Act, however, served other purposes including providing a “popular and wise method of disposing of the public

lands” (p. 250). The Act established a complex partnership where the federal government provided an incentive for each state to sell Western lands and to use the proceeds to establish advanced instructional programs (Thelin, 2011, p. 76). In 1890, a second Land Grant Act provided additional funding to ensure blacks had access to a college education by allowing the creation of predominantly African-American Land Grant Colleges; the act also limited funding to colleges that denied admissions on the basis of race or color (p. 86). The Morrill Land Grant Act helped open higher education to a wider public, while at the same time advancing service to society and meeting the needs of a growing nation.

An early legacy of the Morrill Act was to consolidate the notion that the land-grant colleges were a useful and collective idea (Thelin, 2011, p. 137). By the early 1900s the state-land grant institutions were providing practical instruction and services for the benefit of their communities in areas such as agriculture, mining, military training, and civil engineering (p. 136). These institutions also developed close working relationships with federal agencies such as the Department of the Interior, Agriculture and War (p. 137). This commitment to public service spread to both private and public universities and was evident at the state and local level as well. University engagement and involvement in public policy decisions, for example, was at the core of the Wisconsin Idea. Central to this idea was the involvement of the university in matters of the state and in the deep commitment to addressing and solving society’s problems. The Wisconsin idea “placed the people’s university at the service of the people” (Rudolph, 1990, p. 363). This spirit was present at other state universities. The University of Michigan initiated a program that made it the coordinating center for the entire state

public school system; professors would travel throughout the state to inspect high schools (Thelin, 2011, p. 138). In California, the overarching idea in higher education was “that utility was to be fused with educating for character and public service” (p.140). Universities had a mission of service in an effort to better the condition of its citizens. The expansion of public and private universities continued throughout the early 20th century. After World War II federal programs such as the GI Bill helped returning veterans and service personnel attend university while direct investment in university-based research helped fuel the growth of the modern American research university through the latter part of the 20th century (Mumper, Gladieux, King & Corrigan, 2011).

Bayh-Dole Act. The Bayh-Dole Act of 1980 can be seen as a natural progression of this expansion and investment in university-based research. This Act allows universities and small businesses to retain title to inventions made with or stemming from federal research funding (Slaughter & Rhoades, 2011). The Bayh-Dole Act facilitated the ownership, transfer and commercialization of university based inventions and products that helped maintain the long history of American dominance in innovation and discovery. Economic and technological pressures of the 1960s and 1970s in addition to competitive forces hinted at a decline in American technical innovation and dominance. With regards to policy, the Bayh-Dole Act was the culmination of these pressures and was an attempt to maintain U.S. dominance in technology, discovery and innovation. The Act led to an explosion of technology transfer offices at universities. The aim of these offices was to harness and commercialize university based products and innovation. These efforts based on policies have amounted to millions of dollars in licensing income, patents and prestige

for American universities and has resulted in nearly all major research universities having a technology transfer office (Grimaldi, Kenney, Siegel & Wright, 2011). Critics point to the Bayh-Dole Act as having a negative influence on institutions by helping to commercialize university activities, but the economic impact of this legislation cannot be ignored with over \$40 billion and 270,000 jobs contributed to the U.S. economy in 1999 (Hodges & Dubb, 2012, p. 5). The Act brought about “a large expansion of university local economic development activity by enabling universities to profit from their professor’s discoveries” (p. 5).

These governmental policies, whether enacted at the local, state or national level play an important role in affecting the actions and reactions of stakeholders. Many of the policies discussed such as the Morrill Land Grant Act or the Bayh-Dole Act and portions the Recovery Act have influenced higher education institutions in their actions and relationships with their communities and constituencies. Many of the policies discussed have had a large scale effect on higher education and stand as clear examples of what the term public policy means - those actions “that government intends to do” and “chooses not to do” (Birkland, 2005, p. 17). Public policy by definition affects a greater number and variety of people and interests than do private decisions and actions (p. 18). As part of government policies, universities and colleges are recipients of federal and state support used to fund university activities such as financial aid programs, infrastructure projects, teaching, research and other activities that support the mission of higher education institutions. Universities then become agents of these policies as they interpret and implement the policies, putting the “policies into effect” (p. 18). Table 2 lists selected, influential federal legislation that has affected institutions of

higher education in the U.S. (Digest of Education Statistics, 2012; “Federal Role in

Table 2 <i>Influential Federal Legislation Affecting Institutions of Higher Education in the U.S. (Selected)</i>		
Year	Legislation	Description/Purpose
1862	First Morrill Act	Authorized public land grants to the states for the establishment and maintenance of agricultural and mechanical colleges (established Land Grant higher education institutions)
1867	Department of Education Act	Authorized the establishment of the U.S. Department of Education to collect information on schools and teaching to help states establish effective school systems. (With respect to higher education, the data gathering function is now part of the National Center for Education Statistics, established in 1974, and the Integrated Post-Secondary Education Data System).
1890	Second Morrill Act	Provided funds, resources and grants for support of instruction in the agricultural and mechanical colleges.
1917	Smith-Hughes Act	Provided grants to states for support of vocational education.
1935	Bankhead-Jones Act	Authorized grants to states for agricultural experiment stations.
1944	Servicemen’s Readjustment Act	Also known as the GI Bill, provided assistance for the education of veterans.
1965	Higher Education Act	Provided grants for university community service programs, college library assistance, library training and research, strengthening developing institutions, teacher training programs, and undergraduate instructional equipment. Authorized insured student loans, established a National Teacher Corps, and provided for graduate teacher training fellowships.
1980	Bayh-Dole Act	Allowed universities and small businesses to retain title to inventions made with federal R&D funds.
2009	American Recovery and Reinvestment Act	Provided \$100 billion to state education systems and supplemental appropriations for several Department of Education programs
2010	Health Care and Education Reconciliation Act (SAFRA Act)	The SAFRA Act ended the federal government’s role in subsidizing financial institutions that make student loans through the Federal Family Education Loan (FFEL) Program, expanded the Federal Direct Student Loan Program administered by the Department of Education

Education,” 2013; Fuller, 2011; Mumper, et al., 2011; Slaughter & Rhoades, 2011).

Universities continue to play an important role in the implementation of these large scale policies as they are developed and enacted. Organizational adaptations and change naturally occur in answer to these new policies. In the next sections, two specific roles for the “university as agent” of engagement and development are discussed.

The University as Agent of Engagement

In its role as agent of engagement, the university is classified based on its focus, activities, and purpose. Classifying universities is useful for comparing and evaluating differences among institutions and for understanding why institutions may act or operate in certain ways. Classifying universities and understanding their purpose of engagement and activities helps not only to define the institutions but may also impact how important institutional factors are identified and how scarce resources are allocated to accomplish institutional goals.

Classifying the University

The Land Grant Act created the flagship state university and helped pave the way for increasingly engaged institutions that helped to address society’s needs and provided a supply of educated, trained and productive citizens. It expanded access to higher education for millions of Americans. The rise and prominence of the research university is also a reflection of the close engagement between universities, government, industry and the communities served by these institutions. The Bayh-Dole Act provided an incentive or at least promoted the commercial aspirations of researchers and institutions who are able to bring their discoveries and innovation to the market at large through ownership of their intellectual property (Etzkowitz, 2002). Through portions of the Recovery Act, universities engaged in activities as a way of

continuing their efforts to stimulate the economy through employment, discovery and innovation through government funded research (Recovery.gov). Whether dealing with social needs or economic realities, the university is shaped by policies and their intended or unintended consequences. Universities are engaged agents in the communities they serve.

But what does it mean to be an ‘engaged university’? The Carnegie Foundation for the Advancement of Teaching, an independent policy and research center founded by Andrew Carnegie in 1905, has developed a widely recognized classification framework for describing and categorizing American higher education institutions (“About Carnegie,” 2013). For over 40 years these classifications have helped provide a widely used, if not reliable, mechanism for comparing American universities and colleges.

Under the basic classifications, two and four-year institutions are grouped into classifications based on nationally available data, profiles, and criteria. Doctorate granting institutions for example, are grouped into, “very high-research,” “high research,” and “research,” based on the research activity level and based on the level of research and development expenditures (“Methodology Basic Classification,” 2013).

Updated in 2010, these classifications also include the voluntary Community Engagement classification. This voluntary classification (meaning universities and colleges submit their own data and documents to Carnegie Foundation for review and designation approval based on stated criteria) serves to acknowledge universities and colleges who take an active role in their communities. It is important to note that unlike the other classifications (undergraduate and graduate, enrollment profiles, size and

setting, etc.), which are based on secondary analysis of comprehensive national data, the Community Engagement classification is voluntary and as the Foundation states, it permits the “analysis of attributes that are not available in the national data” (“About Carnegie Classification,” 2013). Nevertheless, the classification recognizes universities who have invested considerable resources in their communities.

The Community Engagement classification includes institutions who may exhibit ‘Curricular Engagement’ or ‘Outreach and Partnerships,’ or both. As of 2010, universities seeking the Community Engagement classification must demonstrate evidence for both criteria. Curricular engagement refers to institutions:

where teaching, learning and scholarship engage faculty, students, and community in mutually beneficial and respectful collaboration. Their interactions address community-identified needs, deepen students’ civic and academic learning, enhance community well-being, and enrich the scholarship of the institution. (“Community Engagement Classification,” 2013).

Outreach and Partnerships refers to institutions:

that provided compelling evidence of one or both of two approaches to community engagement. Outreach focuses on the application and provision of institutional resources for community use with benefits to both campus and community. Partnerships focuses on collaborative interactions with community and related scholarship for the mutually beneficial exchange, exploration, and application of knowledge, information, and resources (research, capacity building, economic development, etc.). (“Community Engagement Classification,” 2013).

A key component in these categories is the idea of “mutually beneficial” and the “exchange of knowledge and resources” implying that the relationships with the community are voluntary and good for all involved, a two way relationship. Starting with the 2010 Classification, universities and colleges must meet and show proficiency in all of these areas in order to gain this classification. Research, capacity building and economic development all form part of the classification demonstrating that community partnerships can be complex and may encompass a wide variety of activities and projects.

In October 2014, the Carnegie Foundation for the Advancement of Teaching announced that it was transferring the responsibility for the Carnegie Classification of Institutions of Higher Education to the Indiana University Bloomington’s Center for Postsecondary Research (CPR). This move was accompanied by an award of \$500,000 from Lumina Foundation to CPR to “update and enhance the Carnegie Classification” to reflect the changing higher education landscape (“IU Research Center,” 2014). The classification will retain the Carnegie name but will be administered by CPR beginning in January 2015. The basic classifications are updated every five years with a major revision and update scheduled for late 2018. In January 2015, the Carnegie Foundation announced the recipients of the Community Engagement Classification. The application process for this designation is administered by the New England Resource Center for Higher Education at the University of Massachusetts Boston. In January 2015, 240 U.S. colleges and universities, 83 newly classified and 157 re-classified, were selected to receive the community engagement classification. Of the 83 new classification recipients, 29 also have the basic classification of research

universities (“Carnegie Foundation Selects,” 2015).

Engagement activities can vary greatly in scope and purpose. Some community engagement activities may center on civic engagement or engagement that involves capacity building activities such as education and crime prevention. Other engagement activities may center on business activities, job creation, or other economic development activities. Although related, a distinction can be made between university-community partnership work and university economic development activities (Hodges & Dubb, 2012, p. 3). University-community partnership work evolved to incorporate community work and the university curricula using service learning as an effective mechanism for blending academic work and efforts for building civic minded and engaged students and faculty (p. 4).

Purpose of Engagement and Activities

Although the modern university is engaged, there has been some resistance in the wide acceptance of engagement and service as part of the regular mission of the university. Some larger, more complex and decentralized research universities have been slow in adopting these practices (Weerts & Sandman, 2010). Acceptance may vary greatly by unit or discipline and may face resistance from faculty who have built successful careers and reputations on more “traditional forms of scholarship” (p. 633).

Also, for many years the dominant purpose of higher education has been to prepare better workers rather than citizens who represent the best of democratic virtues and who seek civic engagement (Hutcheson, 2007). Two ongoing institutional impediments to the development of teaching as a democratic and engagement activity are the “impetus to reproduce researchers” and the “drive for institutional prestige” (p.

113). Another impediment may be promotion and tenure policies that do not recognize, value or reward faculty service or engagement efforts. In this case, faculty do not have the incentive to carry out engagement activities.

Wade and Demb (2009) identified factors that may affect the likelihood of faculty taking part in service or engagement activities. These factors fall along institutional, professional and personal dimensions and may affect the likelihood of faculty engagement. The authors developed the Faculty Engagement Model (FEM) based on their review of relevant literature and identified nine factors on the institutional dimension: mission and priorities, leadership, institutional policies, budget and funding, engagement structure, faculty involvement, community involvement, institutional type, and prestige (p. 8-9). Key among these are tenure and hiring procedures and integration of engagement into mission and resources. Despite these factors public service and academic work can form an “inseparable whole” (p. 6). Finally, the authors state that service learning is the most common pedagogical method used to link classroom learning to the service mission of universities (p. 7).

Meeting or addressing a community-identified need can be a major component of service learning and community engagement activities. However, there can be a fundamental break between the engaged university and the entrepreneurial university in terms of the set of norms, governance, social relationships, and organizational arrangements within the university. The engaged university and the entrepreneurial university differ most fundamentally in the institutionalized norm of commitment to ‘open science’ and the view of knowledge as a ‘public good’ versus ‘knowledge as commodity’ (Goldstein, 2010, p. 89).

Since the early 1980s “we have moved from a system of science in society dominated by a vision of science as public good to a system dominated by a vision of science as mainly a financial good” (Pestre as quoted in Jacob, 2009). This idea of science as commodity and also viewing higher education as a commodity presents challenges for policy makers and institutions. What about the public good? What about learning for learning’s sake? Are there winners and losers? How do policy makers handle or manage conflicts of interest? The management or “governance of public science, otherwise known as research and innovation policy” normally deals with the allocation of scarce resources to different areas of inquiry, compensation for market failures in research and development investment, the pursuit of common interests (problems affecting society), and promoting the dissemination of scientific knowledge to the whole of society (Jacob, 2009, p. 399-400). The commodification of science and higher education then presents challenges to policy makers who must wrestle with issues that have far reaching effect and impact. With respect to universities and university research activities, the idea of commodification creates markets for outputs such as those of intellectual property - patents, licenses, trademarks, etc. Policies such as the Bayh-Dole Act, have facilitated and “streamlined universities’ participation in the marketplace” (Slaughter & Rhoades, 2011, p. 443). These outputs create opportunities for revenue generation, income and other economic development activities.

The University as Agent of Development

At the core of the ideals, agendas and public policies related to higher education is the question of the role and purpose of the university. The literature speaks to the idea of higher education as a public or private good. A public good in economic terms is

a good that is non-rival and non-excludable meaning that if an individual consumes that good it doesn't affect any other individual from consuming the good or exclude others from the good (Gruber, 2007). Within the last thirty years, the benefit of higher education "shifted from one of being a "public good" to benefiting the individual and thus, the individual should shoulder a greater share of the cost" (The Research Universities Futures Consortium, 2012, p. 62). This shift also included the idea that universities needed to demonstrate an economic benefit (p. 62). This shift in ideas is reflected in enacted policies as well as the activities borne by institutions. Legislation such as the Morrill Act of 1862 and the Bayh-Dole Act of 1980 encouraged universities as well individual academics to explore and foster relationships, activities, and varying arrangements such as research parks, incubator facilities, and technology transfer offices that promote commercial activities and economic development (Etzkowitz, 2002).

Community and Economic Development

Many metropolitan areas have experienced years of systemic problems such as crime, blight, and poverty. In many of these metropolitan areas, universities and colleges play an indispensable role in activities that try to address these issues. Institutions of higher education are net contributors to the well-being of modern economies. These institutions contribute in a positive way through various mechanisms including employment, attracting revenue and expense streams and contributing to the development of the knowledge economy (Batterbury & Hill, 2004). In a knowledge economy, value is added through the application of ideas and information, especially through research and development, which secures a "competitive advantage" for the

locality or region (p. 38). With government encouragement, universities have embraced their “third mission” activities of impacting the local and national economies. A key role of higher education is to raise the education and skill level of students who in turn increase their productive potential and capacity in driving the knowledge economy; from this perspective of yielding future returns, higher education becomes an “investment” and presents economic opportunity for future prosperity (p. 39). Increasingly however, public policies are shifting the cost of investment in higher education from the public sector to the individual which seems counterintuitive given the benefit potential to society at large.

The idea of capacity and economic development follows from a framework that connects community development to economic development and their outcomes. Community and economic development are inextricably linked and should be treated as a unified system in order to maximize and achieve optimal policy outcomes (Pittman, Pittman, Phillips & Cangelosi, 2009). Pittman, et al., contend that the definitions of community and economic development are parallel. Community development produces assets for improving business climate and quality of life; in turn, economic development mobilizes these assets to realize benefits to the community. Community development creates a “development ready” community: a good labor force, quality of life, infrastructure, a good place to live and work, education system, government, etc., that attracts investment and businesses and facilitates economic development (p. 81).

Pittman et al. (2009) propose a framework that describes this dynamic system, a community and economic development chain. The capacity building (or community development process) leads to social capital (capacity), which leads to community

development outcome (improving the community in all aspects). Communities that have capacity or social capital have the ability to act and to create good economic development processes. When these communities take action they can create and maintain effective initiatives that mobilize the community's resources leading to positive economic development outcomes. This framework describes a systems process with a feedback loop showing that good community and economic development outcomes produce additional resources the community can use to create capacity for more action (p. 82). Community and economic development are interrelated processes and mutually beneficial activities. Policy makers need to recognize they are inextricably linked.

If it follows that community and economic development are intertwined, and universities have a third mission to impact their economies, then universities and colleges are well positioned to encourage community and regional development through their institutional activities. Trani and Holsworth (2010) describe universities as developers of social capital as well as healthcare providers and partners in regional development, playing a key role in the revitalization of urban communities and the economic development of regions, states and nations. Universities and colleges are described as "indispensable actors" in the social and economic development of modern society, "at almost every level and in almost every venue" (p. 2). Whether these higher education institutions serve as community colleges, state universities, elite private institutions, or are located internationally, they are uniquely positioned to be partners in their communities; they are not easily pigeonholed in the policy process to any particular side of an issue, as the scope of their activities can advance scientific driven economic

development and promote healthy living just as easily as empowering “citizens in distressed neighborhoods to invent a better future” (p. 44).

As discussed, there is considerable debate within the academy regarding the role of the university related to entrepreneurial activities which promote economic development. Some criticize economic development activities of more entrepreneurial universities as an erosion of the idea of institutional commitment to ‘open science’ and knowledge as a ‘public good’ versus ‘knowledge as commodity’ which may give rise to conflicts of interest (Goldstein, 2010, p. 89). Universities have taken a dramatic entrepreneurial turn in the last 10-15 years as evidenced by the “proliferation and enlargement of technology transfer offices, the increase in the number of invention disclosures, patents and licenses, changes in universities’ mission statements, and changes in tenure and promotion criteria” (p. 84). For some the idea of the entrepreneurial university is in conflict with the traditional model of the ivory tower centered on instruction and research and the ‘formation of the person’ (p. 86). “At its heart the university is a reservoir of intellectual capital: its most fundamental purpose is about the creation, testing and application of knowledge” (Watson, 2007, p. 14). Despite this conflict, there is evidence that these activities do have a direct impact on economic measures. In a recent study, Roessner, Bond, Okubo, and Planting (2013) used an input-output model of university activity to estimate the economic impact of licensed commercialized inventions stemming from university research. Roessner et al., estimate that the impact of these activities to gross domestic product ranged from \$10 billion to \$22 billion (in 2005 dollars) in 2010 alone (p. 31).

The University and Models of Output

There are many examples of methods as well as pitfalls involved in measuring the economic benefits and economic impact of university research and university activities (Salter & Martin, 2001; Siegfried, Sanderson, & McHenry, 2007). Regardless of the methods, measuring outcomes and providing evidence of performance has become a crucial activity for universities especially when dealing with key stakeholders and policy makers.

The Center for Measuring University Performance (MUP) at Arizona State University, for example, publishes an annual report on top American research universities by looking at nine indicators of university activity and output including total research and development expenditures, federally sponsored research and development expenditures, number of members of the National Academies among an institution's faculty, number of significant faculty awards earned as indicators of faculty distinction, doctorates awarded, number of postdoctoral appointments supported, median SAT scores, endowments, and annual giving. Central to MUP analysis is the idea that when evaluating and comparing institutions, research matters more than anything else in identifying the best institutions. Faculty, as exemplified by the number of members of the National Academies and the number of significant awards earned, are an important factor in identifying top universities. Likewise, students provide a measure of perceived quality of the institutions and is exemplified by doctorates awarded, number of postdoctoral appointments supported, and median SAT score as an indicator of student competitiveness ("The Top American Research Universities," 2014). Number of publications is not listed as one of the top indicators when

comparing institutions or to determine university performance.

Documenting and providing evidence of performance has become important to universities, key stakeholders, and policy makers. Federal policy makers, for example, may expect federally funded research to “stimulate economic recovery through discovery and technological innovation, as well as product and process development” (Leslie, Slaughter, Taylor & Zhang, 2012, p. 615). Additionally, both federal and state bodies interested in economic growth, may hold universities accountable and “expect research dollars to be expended by universities for research support” (p. 615).

Models linking university inputs to measures of output or performance provide a tool for understating resource allocation, efficiency, and accountability. Research expenditures, for example, represent economic activity in terms of monies spent in support of research and research related work. Zhang and Ehrenberg (2010) identified associations between faculty employment and changes in university research expenditures. The authors identified a positive relationship among full-time tenured or tenure track faculty and research expenditures and graduate student enrollment and research expenditures (p. 335-336). These relationships may have policy implications in terms of recruitment, hiring and retention at research institutions. In a similar analysis, David (2013) looked at determinants of research productivity by studying the inputs required to produce top-level academic research at U.S. universities and determines that university performance is linked to revenue and the share devoted to research production, size, measured by staff and revenue, and the quality of hired staff (p. 82). These models (David, 2013; Leslie, Slaughter, Taylor & Zhang, 2012; Zhang and Ehrenberg, 2010), summarized in Table 3, use regression analysis techniques to

identify causal relationships between input variables and output variables. All of these models look at similar or related variables such as faculty, students, revenues, and other institutional characteristics. Several important variables are missing from these analyses however and present an opportunity or gap for investigation. Student selectivity for example presents an interesting variable for investigation. In addition, the community engagement classification, mentioned above, presents another interesting avenue for investigation. The level of patent applications (as a proxy for entrepreneurial activities) may also contribute to the institutional profile. The characteristic of private versus public was explored in some of the models above but needs to be revisited in terms of the framework for this study.

Table 3 <i>Examples of Input Output Institutional Models</i>		
Author/Title	Model and Method	Results
Zhang, L., & Ehrenberg, R. G. (2010). Faculty employment and R&D expenditures at research universities. <i>Economics of Education Review</i> , 29(3), 329-337.	<ul style="list-style-type: none"> -R&D expenditures is a function of: -Number of full-time faculty members at the institution -Share of part-time faculty among all faculty at the institution -Share of the full-time faculty at the institution that are not on tenure-tracks in the year -Institutionally financed R&D expenditure at institution i in year t – 1 -Weighted average of the funding provided by federal agencies in the year -Student enrollment at institution i in the year -Institutional fixed effects -Time fixed effects and random error term -Regression analysis using panel data (1990-2004) -NSF Survey of R&D Expenditures (223 institutions) -College Board's Annual Research data and IPEDS Faculty Salary Survey 	<ul style="list-style-type: none"> -Full- time faculty, tenured or tenure-track, main category generates external R&D funding -Increase in graduate enrollment associated with increase in external research expenditures

Table 3

Examples of Input Output Institutional Models

Author/Title	Model and Method	Results
<p>Leslie, L. L., Slaughter, S., Taylor, B. J., & Zhang, L. (2012). How do revenue variations affect expenditures within U.S. research universities? <i>Research in Higher Education</i>, (6), 614-639.</p>	<ul style="list-style-type: none"> -Dependent variables (1) instruction, (2) research, (3) public service, (4) academic support, (5) student services, (6) institutional support, (7) scholarship and fellowships -Independent variables (1) tuition and fees, (2) appropriations, (3) grants and contracts, (4) gifts, (5) sales and services, (6) other revenues -Pooled regression analysis (academic year 1984–1985 to 2007–2008) -IPEDS Research Extensive Institutions (96 research extensive universities in 2007–2008) 	<ul style="list-style-type: none"> -For public institutions, gifts, grants, and contracts main drivers for expenditures in research -For private institutions, Gov. grants and contracts revenues main driver for expenditure in instruction and research
<p>David, Q. (2013). Determinants of research production at top US universities. <i>The B.E. Journal of Economic Analysis & Policy</i>, 14(1), 81-109.</p>	<ul style="list-style-type: none"> -Academic research (index) function of -Log total revenue in millions of US\$ -Number full-time professors -Number full-time assistant and associate prof. -Share revenue spent on research activities -Proportion of students in hard science fields (proxy for the specialization of the institution) -Average salary of the professors -Control variable: dummy for the state where university located -Academic Ranking of World Universities (164 top U.S. institutions) -IPEDS(data from 2005) 	<ul style="list-style-type: none"> -Size, revenue and expenditure increase production -Most powerful factor for research production is institution's total revenue -U-shape relationship between quality of professors and research prod. -Need something more to close gap with most top-ranked universities -Top universities are best because have best characteristics but also something else makes them unique

Based on the literature and discussion above, the main factors examined in this study (and further described in Chapter III) include percentage of full-time tenured or tenure track faculty, student and student selectivity or competitiveness, the level of institutional engagement, the level of entrepreneurship, and the level of institutional performance. The following section describes the worldview and theoretical framework which guided the analysis.

Worldview and Theoretical Framework

Creswell (2009) suggests that any research design or plan should include a description of the philosophical worldview that can serve as a “general orientation about the world” (p. 6). Of the four major worldviews identified by Creswell (p. 6-11), Postpositivism, Constructivism, Advocacy/Participatory, and Pragmatism, the Postpositivist worldview describes relationships explored in this study. The Post-positivist Worldview holds a deterministic philosophy “in which causes probably determine effects or outcomes” (p. 7). This philosophical worldview is consistent with reducing ideas to measurable variables that can be empirically tested through hypotheses and research questions that verify or refine theories governing the world (p. 7).

Consistent with this deterministic philosophy, the theoretical frameworks (see Figure 1) used in this study are systems theory and neoliberalism. These two theories provide a framework that can be used to conceptualize and explore the current state in higher education and the relationships affecting universities and colleges in the U.S.

First, systems theory provides a framework for understanding the many factors affecting universities and colleges as well as the implications of challenges and opportunities faced by these institutions. Easton (1957) presented systems theory as a method for understanding complex political systems arguing that each part of the

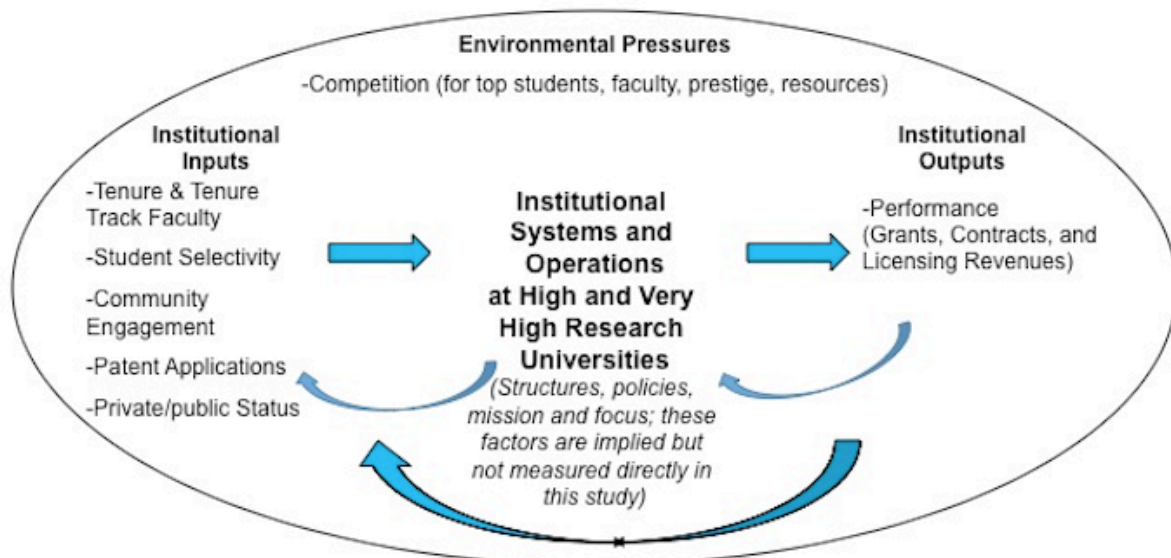


Figure 1. Theoretical and Conceptual Framework: Systems Theory and Neoliberalism at High and Very High Research Universities

political system does not stand alone but is related to each other part, and that the operation of no one part can be understood without reference to the way the whole system operates (p. 383). This theory implies a systematic approach driven by inputs that are converted by the processes of the system into outputs which in turn affect the environment and the system itself (p. 384). These concepts can be adapted to gain an understanding of the higher education system. In much the same way, the higher education system presents with a set of inputs which are converted into outputs by the operational activities of these institutions. The outputs in turn feed back as inputs to the system and may affect the environmental factors as well. Universities and colleges operate in this systems framework where many factors can influence their operation and

activities. Systems theory and the concept of inputs and outputs is used often in policy-making and analysis (Stewart & Ayres, 2001). In policy-making, systems analysis can “be equated with the building of systemic models” to aid policy-makers in decision making but can also be used for developing analytical and implementation strategies that may lead to viable policy recommendations (p. 91). The concept of inputs and outputs is commonly used, for example, in assessing the economic impact of colleges and universities (Drucker & Goldstein, 2007).

Neoliberalism can add to this framework by identifying many of the environmental, institutional and individual pressures acting upon and within the system. Neoliberalism is here presented as a “theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade” (Harvey, 2005, p. 2). Although perhaps always present, neoliberal thought and practices have been growing in prominence in government and the public sector since the 1970s. In an era of increasing globalization and competition, neoliberal practices have included “deregulation, privatization, and withdrawal of the state from many areas of social provision” (p. 3). With respect to higher education institutions, these market forces can manifest in decreasing state and federal support for institutions, promotion of entrepreneurial and commercialization activities, increasing tuition rates, strategic faculty hiring, curriculum change and development, and increased competition for top students and institutional rankings (Bok, 2003). Because universities are complex institutions serving many stakeholders and have varied missions of education, research,

knowledge dissemination, and engagement, these neoliberal forces provide confounding pressures which cannot and should not be ignored, yet at the same time must be balanced against the greater mission of the university community.

These forces may manifest strongly in high and very high research universities in the U.S. as constraints on resources coupled with increasing competition for rankings, top quality faculty and students, and a pressure to increase research output (which in turn affects rankings) create an environment that is focused on maximizing “return on investment” in a market driven, economic sense, and in a global context (Brown, 2011; Canaan & Shumar, 2008).

Concepts from these frameworks guided the hypothesis and analysis further discussed in Chapter III below and provided context for interpreting the findings of the study. Concepts such as competition, efficiency and generation of revenue define the top priorities for all types of higher education institutions (Saunders, 2010). Institutional leaders will value characteristics or variables that provide a competitive advantage, provide higher levels of prestige, and maximize revenue. Doctoral granting universities are considered the elites among institutions and “for better or worse, the policies and practices at research universities are mimicked by other types of institutions seeking to improve their reputations” (Cohen & Kisker, p. 444). In this highly competitive environment institutions that can attract top-level faculty and students and can use their institutional characteristics and other factors to their advantage are expected to thrive and perform at a higher level. With respect to the academic pecking order, “institutional prestige is related positively and directly to research productivity and scholarship” (Gitlow, Gitlow, Kurnow, & Oppenheim, 2011, p. 79) with research the “unquestioned

priority of the Academy” (p. 55) and the doctoral degree standing as the preferred credential for a successful research career. University reputation is enhanced by successfully competing for talented graduate students and high profile faculty who can produce valuable research results, achieve stable grant support, help balance budgets, transfer and commercialize knowledge, and maintain institutional prestige (Gumpert, 2011). As market driven institutions, universities engage in activities and programs that can differentiate themselves from others and attract motivated students, faculty and resources. The thirty institutions in the U.S. with the largest endowment levels are all research universities that engage in selective admission practices, bring in millions of federal and private research funds, reward faculty based on research activity, maintain large campuses, and offer specialized courses to highly capable students (Cohen & Kisker, 2010).

A challenge for these institutions is understanding the institutional and environmental variables that can be manipulated or combined to maximize the return on investment or return on input factors. The variables of interest, along with the proposed research methodology for this project, are discussed further below in Chapter III and include full-time tenured or tenure track faculty, student selectivity or competitiveness, the level of institutional engagement, the level of entrepreneurship, and the level of institutional performance.

CHAPTER III

METHODOLOGY

This chapter details the research methodology for this project. The design of the project is discussed below including the research approach. The relevant research questions and hypotheses are also presented as well as other design elements like the research model, sampling frame and unit of analysis. This study is based on the models presented in the previous section and looks to add to the literature by including variables not included in the previous models and applying a slightly different conceptual framework to the analysis.

Research Design and Sample

To understand the interaction among selected variables within the higher education environment and in order to create a model of university performance, this study used a non-experimental quantitative research design using secondary analysis from national data sources. Using these sources, this study used panel data where “the same sample is examined at two or more time intervals” (Frankfort-Nachmias & Nachmias, 2008). Panel data was analyzed on high and very high research universities in the U.S. and as defined by the Carnegie Foundation. This study examined U.S. institutions only, Carnegie classified under the 2010 Basic Classification as high research (n=99) and very high research (n=108), for public and private non-profit institutions. The sample of 207 universities classified as high and very high research

universities was extracted from the Department of Education's Integrated Postsecondary Education Data System (IPEDS) and was analyzed for the five year time period from 2008 to 2012. This time period includes variability in not only the national economy but also the world economy and is marked by recessionary forces, government interventions and bailouts as well as decreases in wealth and investments.

Unit of Analysis and Sampling Frame`

The unit of analysis for this study is the individual university or institution. The sampling frame is the current list of high and very high research universities as defined by Carnegie Foundation and as listed in the data compiled by the U.S. Department of Education's IPEDS system.

Research Question and Hypothesis

Within this framework and for the purposes of this analysis the overarching question is:

What are significant factors affecting institutional performance at high and very high research universities?

Five underlying research questions and their relevance are:

-Do universities with a larger number of tenured or tenure track faculty perform at a higher level? Relevance: Tenured and tenure track faculty tend to generate more research and development revenue. There's a competitive market for attracting high performing faculty who may affect university output and thereby prestige and rankings.

-Does student selectivity of the university affect level of performance?

Relevance: There's a competitive market for attracting high performing students who may affect university performance and thereby prestige and rankings.

-Do private (non-profit) universities, by virtue of their financial, non-public status, perform at a higher level when compared to public universities? Relevance: Private universities may hold an advantage over public universities in terms of resources, financial flexibility and prestige.

-Do universities classified as "community engaged" by Carnegie Foundation perform at a higher level than universities not classified as "community engaged"? Relevance: The community engagement designation may provide a level of distinction and differentiation compared to other institutions. In addition it provides evidence of university structures that support and foster community based partnerships.

-Do universities with higher patent application activity perform at a higher level? Relevance: Entrepreneurial activities, including commercialization of faculty patented inventions may lead to increased revenues and commercial recognition.

The related hypothesis tested are listed in Table 4 below.

Table 4 <i>Hypothesis</i>	
Alternative Hypothesis 1 (H_1):	Universities with higher numbers of tenured or tenure track faculty perform at a higher level than universities with lower numbers
Alternative Hypothesis 2 (H_1):	Universities that are more selective in terms of their students have a higher level of performance compared with universities that are less selective
Alternative Hypothesis 3 (H_1):	Private universities by virtue of their status have a higher level of performance than public universities
Alternative Hypothesis 4 (H_1):	Universities classified as “community engaged” by Carnegie Foundation perform at a higher level than universities not classified as “community engaged”
Alternative Hypothesis 5 (H_1):	Universities with higher patent application activity perform at a higher level than universities with lower patent activity

Further explanation of the variables used and their values is described in Table 5.

Table 5 <i>Variable Description and Values</i>		
Variable Name	Description	Value
Performance	<p>Source: IPEDS, AUTM survey - Sum of federal, state, local grants and contracts, and licensing income received, reported on a fiscal year basis.</p> <p>Type: Dependent – Numerical.</p> <p>Rationale and Operationalization: Constructed variable to measure university output. Grants and contracts revenue and licensing revenue is a proxy for institutional performance. Can be seen as a measurable result of university activity and is dependent on many input variables. Likewise it can be an important measure for institutional planning and budgeting.</p>	Measured in dollars

Table 5 <i>Variable Description and Values</i>		
Variable Name	Description	Value
Community Engaged	<p>Source: Carnegie Designation - Reported as part of the institutional characteristics as an elective designation based on activities and information provided to Carnegie.</p> <p>Type: Independent - Categorical.</p> <p>Rationale and Operationalization: Describes if the institution holds a community engagement designation and therefore if community engagement is a key part of the mission of the university. In addition, this variable is used as a proxy for institutional engagement with varied partners, stakeholders and collaborators. Active engagement may have an impact on institutional outcomes and output. In addition this designation may add to the prestige of the university.</p>	<p>Value</p> <p>0 = no designation,</p> <p>1 = designation</p>
Percent Tenure, Tenure Track	<p>Source: IPEDS - Reported annually, used in terms of tenure, non-tenure categories.</p> <p>Type: Independent – Numerical.</p> <p>Rationale and Operationalization: Constructed variable of tenure plus tenure track faculty as a percentage of total full time instructional faculty. One of the most important variables as many university activities, including teaching, research, and service, depend on faculty initiatives and actions.</p>	<p>Measured in percentage of tenure and tenure track faculty</p>
Percent Admitted	<p>Source: IPEDS - Reported annually, reported in terms of applications received and number accepted.</p> <p>Type: Independent – Numerical.</p> <p>Rationale and Operationalization: Used to describe the demand of the institution compared to the number of students accepted. This is used as a proxy measure of competitiveness for highly selective students.</p>	<p>Measured in the percent of applicants admitted to the institution</p>

Table 5 <i>Variable Description and Values</i>		
Variable Name	Description	Value
Private/Public	<p>Source: IPEDS - Reported as part of the institutional characteristic.</p> <p>Type: Independent – Categorical.</p> <p>Rationale and Operationalization: Describes if the institution is supported by public funds or if it operates as a private not-for-profit entity.</p>	Value of 0 = public, 1 = private
Patents Issued	<p>Source: AUTM - Reported as part of the annual survey.</p> <p>Type: Independent – Numerical.</p> <p>Rationale and Operationalization: Describes the number of new patents received by the institution during the year. This is used as a measure of the level of entrepreneurship at the institution.</p>	Measured in the number of new patents issued
Tuition and Fees	<p>Source: IPEDS - Reported annually and represents an important revenue component.</p> <p>Type: Control – Numerical.</p> <p>Rationale and Operationalization: Represents tuition income to the institution. Tuition has increased dramatically at higher education institutions and has been used in cases to compensate for declining state and federal support. It is used as a control variable to isolate its effects on institutional output/performance.</p>	Measured in dollars
Endowment Beginning	<p>Source: IPEDS - Reported annually and represents an important source of income.</p> <p>Type: Control – Numerical.</p> <p>Rationale and Operationalization: Represents level of endowment wealth that creates income to the institution. It is used as a control variable to isolate its effects on institutional output/performance.</p>	Measured in dollars

Table 5 <i>Variable Description and Values</i>		
Variable Name	Description	Value
Medical Degree	<p>Source: IPEDS - Reported annually and designates whether the institution confers medical degrees and therefore has a medical school.</p> <p>Type: Control – Categorical.</p> <p>Rationale and Operationalization: Denotes if the school has a medical school. It represents an important institutional element providing access to medical centers and medical center related activities which may have a positive impact on research revenue and related activities. It is used as a control variable to isolate its effects on institutional output/performance.</p>	Value of 0 = no medical degrees conferred, 1 = medical degrees conferred
Auxiliary Sales	<p>Source: IPEDS - Reported annually and represents an important revenue component.</p> <p>Type: Control – Numerical.</p> <p>Rationale and Operationalization: Represents income from sales and services of auxiliary enterprises that exist to furnish a service to the university community and that charge a fee for the service. It is used as a control variable to isolate its effects on institutional output.</p>	Measured in dollars
<p>Note on sources: IPEDS data is collected annually by the U.S. National Center for Education Statistics from all higher education institutions participating in the federal financial student aid program. Association of University Technology Managers (AUTM) collects licensing data annually via a survey administered to institutions.</p>		

The model and hypothesis were tested using hierarchical multivariate regression analysis using panel data and employing statistical analysis using SPSS software. This method is consistent with other models described in the literature (see Table 3 for summary of David, 2013; Leslie, Slaughter, Taylor & Zhang, 2012; Zhang & Ehrenberg,

2010). The regression output, including the correlation between the dependent and independent variables is described in Chapter IV. The analysis includes a discussion of

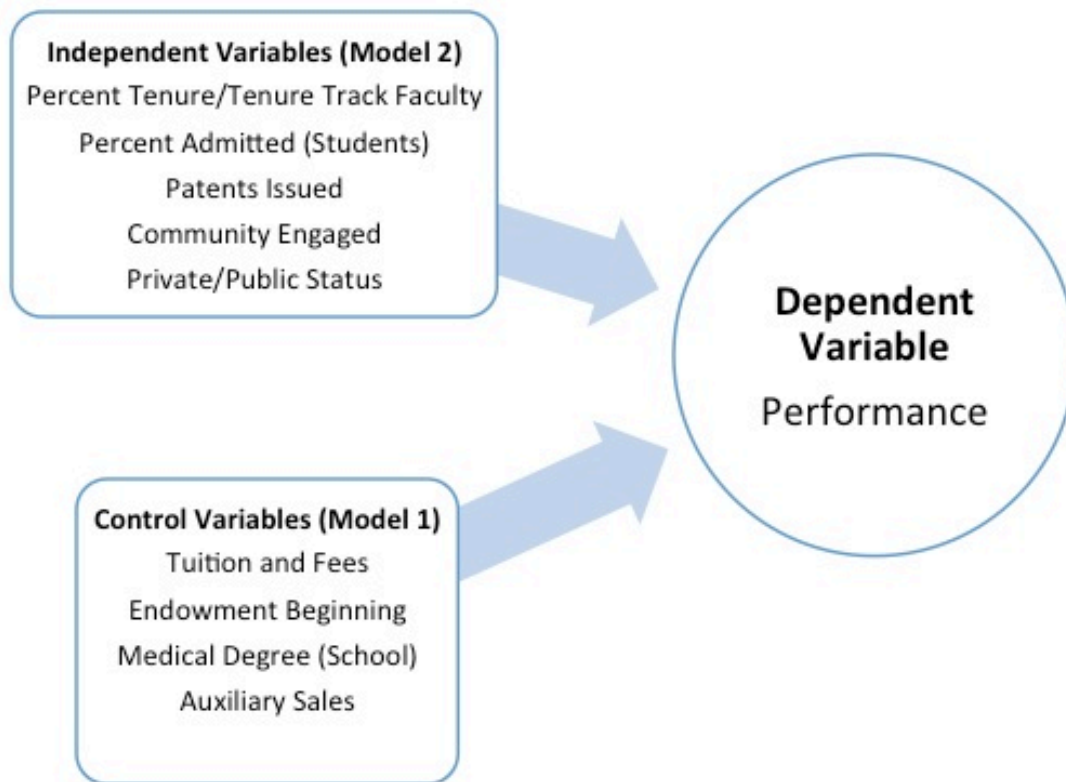


Figure 2. Hierarchical Regression Model – All Variables

the study results. The procedure and steps used for collecting, analyzing the data, and hypothesis testing were as follows:

1. Constructed data set using IPEDS, AUTM, and Carnegie Foundation source information and incorporated the variables as described in Table 5 above and in this section.
2. Analyzed the data set using SPSS to include descriptive statistics and regression functions.
3. Ran hierarchical, multivariate regression analysis between the dependent variable and the independent variables in SPSS. Figure 2 shows a graphic of the hierarchical regression model used. In Model 1, the control variables were analyzed against the dependent variable. Model 2 added the independent variables of interest to the hierarchical regression.

Underlying Assumptions of the Model

The sample of high and very high research universities assumes the institutions (by definition) regard research to be an important institutional mission and agenda item.

Table 6 lists assumptions used in the model.

Table 6 <i>Assumptions Used for Analysis Model</i>
<ol style="list-style-type: none">1. A competitive environment exists for students, faculty and funding2. Grants and contracts revenue and licensing revenue is a proxy for institutional performance3. Higher performance (higher revenues) is desirable by institutions4. High and very high research universities are used in the analysis as representative of the top echelon of higher education institutions in the U.S.5. Institutions seek to ascend in status, category, or rankings6. The community engagement designation implies the institution is active in the community and seeks partnerships and collaboration as part of the institutional mission7. Number of new patents issued and received is used as a proxy measure for entrepreneurship activities8. Other major performance measure, number of publications, is important but not used in this analysis

Given the theoretical and conceptual framework of the study, the model assumes that resources are utilized and, to the extent possible, variables are affected to maximize the institutional performance and thereby prestige (Stocum, 2013). For example, to the extent that institutional budgetary policy allows, faculty who are engaged in research would be preferred (hired) because of their potential contribution to institutional performance over part-time faculty or faculty who are not engaged in research (Zhang & Ehrenberg, 2010). Also, the more institutional actors are engaged in entrepreneurial activities, the greater the institutional performance is expected (Slaughter & Rhoades, 2011). To the extent that institutions can attract greater resources, for example, highly selective students, institutions will seek to maximize

performance by allocating resources accordingly thereby increasing prestige and rankings, and reinforcing an institution's "mission differentiation" (Stocum, 2013, p. 11). Finally, institutions that are deemed to be engaged in their communities are assumed to have a greater opportunity for partnerships, collaborations, and work that may or may not ultimately have an impact on performance and lead to additional allocation of resources. As one example, the Tulane University Cowen Institute for Public Education Initiatives was founded in 2006 by a grant from a benefactor foundation to support the Institute's work in education and in service to the community ("Cowen Institute History", 2015).

Chapter IV follows with a description of the results of the data analysis.

CHAPTER IV

DATA ANALYSIS

This chapter presents the results of the data analysis. As previously described, the analysis data set was created using available data from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), the Association of University Technology Managers (AUTM), and the Carnegie Foundation for the Advancement of Teaching. Using these sources, panel data was analyzed on high and very high research universities in the U.S. and as defined by the Carnegie Foundation classifications.

This study examined U.S. institutions only, Carnegie classified under the 2010 basic classifications of high research (n=99) and very high research (n=108), for public and private non-profit institutions. The sample of 207 universities classified as high and very high research universities was extracted from the Department of Education's Integrated Postsecondary Education Data System (IPEDS) and was analyzed for the five year reporting time period from 2008 to 2012.

SPSS was used to create a model of institutional performance using hierarchical multivariate regression as described in Figure 2 in the previous chapter. The resulting model and analysis were used to help answer the research questions and related hypotheses listed in Table 4. Below is a description of the data as well as the results of the hierarchical regression analysis within the context of the stated research questions

and associated hypotheses.

Description of the Sample and Model Results

The data for the sample of 207 universities classified as high and very high research universities was attained by creating a custom data set in IPEDS using the 2010 Carnegie Basic Classifications for the five year reporting time period from 2008 to 2012. Data for each of the 207 universities was collected for each year of the five-year analysis. Table 7 presents a description of the panel data analyzed. Within the sample, N denotes the number of cases analyzed for each variable used in the model.

Table 7

Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Performance	1035	0	1664920000	234077810.87	275824774.616
Tuition_Fees	1030	0	1428580000	234190930.85	190962591.057
Endow_Begin	1012	0	36926693000	1290899098.94	3258268122.423
Medical_Degree	1035	0	1	.48	.500
Auxiliary_Sales	1030	-21895305	604066567	80095341.50	80663732.465
Percent_Tenure_Ttrack	1035	.03	1.00	.6791	.14375
Percent_Admitted	1003	.00	1.00	.5770	.22946
Patents_Issued	653	0	371	27.51	39.731
Comm_Engaged	1035	0	1	.36	.481
Private_Public	1035	0	1	.29	.454

Note. Valid N (listwise) = 631

For data years 2008 and 2009, minor recoding for 14 institutions out of the 207 was necessary for consistency and for comparison in moving from the 2005 Carnegie classifications to the 2010 Carnegie Basic Classifications for high and very high research universities used in this analysis. For the 2008 data year, one institution was

recoded to very high research university from “Special Focus Institutions-Medical schools and medical centers,” two were recoded to high research university from “Master's Colleges and Universities (larger programs),” and eleven were recoded to high research university from “Doctoral/Research Universities.” The same recoding was necessary in the 2009 data year. Starting with the 2010 data year, these 14 institutions retain this recoding (one very high research and thirteen high research) under the 2010 Basic Classification, the classification used on this study. For the 2010 data year, one institution was recoded to high research university from “Schools of Engineering.” This recoding was consistent with the university’s classification as a high research university for the other years in the analysis.

Multicollinearity. A check for multicollinearity, or whether predictor variables are highly correlated, was performed and the results indicate the variables in the model do not exhibit high levels of collinearity. Table 8 shows that the Variance Inflation Factor (VIF), an indication of multicollinearity, are low for all the variables. The lower the VIF the better the indication that multicollinearity is low among the variables and is not problematic to the analysis. Acceptable values range from four to ten (O’Brien, 2007). The VIF values in this study are all lower than two, giving the indication that variables in the sample do not have a high level of collinearity and therefore any potential estimation problems or issues are minimized. This means that a predictor variable or a combination of variables cannot accurately predict (interfere) with the value of the other.

Table 8. <i>Collinearity Values</i>		
	Collinearity Statistics	
Model	Tolerance	VIF
1 (Constant)		
Tuition_Fees	.613	1.633
Endow_Begin	.895	1.117
Medical_Degree	.857	1.167
Auxiliary_Sales	.618	1.618
2 (Constant)		
Tuition_Fees	.525	1.904
Endow_Begin	.671	1.491
Medical_Degree	.715	1.399
Auxiliary_Sales	.600	1.667
Percent_Tenure_Ttrack	.749	1.336
Percent_Admitted	.525	1.907
Patents_Issued	.725	1.380
Comm_Engaged	.853	1.172
Private_Public	.642	1.559

Dependent Variable. As described in Chapter III, the variable Performance is constructed and defined as the:

-Sum of federal, state, local, private grants and contracts, and licensing income received, reported on a fiscal year basis.

From IPEDS, the following variables were added to form the Performance variable from *public* institutions each year – Federal Operating Grants and Contracts,

State Operating Grants and Contracts, and Local/Private Operating Grants and Contracts; from *private* not-for-profit institutions – Federal Grants and Contracts Total, State Grants and Contracts Total, Local Grants and Contracts Total, and Private Grants, and Contracts Total.

Under IPEDS, the variables for federal, state, local, and private grants and contracts, are uniquely named and collected for public versus private not-for-profit institutions. Historically, private not-for-profit institutions reported revenues under the Financial Accounting Standards Board (FASB) rules and public institutions reported under the Governmental Accounting Standards Board (GASB) rules. Beginning with 2008, a new “Aligned Form” was phased in for both FASB- and GASB-reporting institutions that has improved comparability in reporting, with some differences. The Aligned Form became mandatory for all institutions in 2010 (“IPEDS Finance Data,” 2016).

Licensing income received was added to the Performance calculation from the AUTM annual survey data appendix for years 2008 (Blumenstyk, 2010) and 2009-2012 (AUTM, 2009, 2010, 2011, 2012).

Table 9
Model Summary^c

Model	Change Statistics								
	Adjusted			Std. Error of	R Square	F	df1	df2	Sig. F
	R	R Square	R Square						
1	.701 ^a	.492	.489	197198189.920	.492	153.548	4	634	.000
2	.836 ^b	.699	.695	152386682.992	.207	86.540	5	629	.000

a. Predictors: (Constant), Auxiliary_Sales, Endow_Begin, Medical_Degree, Tuition_Fees

b. Predictors: (Constant), Auxiliary_Sales, Endow_Begin, Medical_Degree, Tuition_Fees, Comm_Engaged, Patents_Issued, Private_Public, Percent_Tenure_Ttrack, Percent_Admitted

c. Dependent Variable: Performance

Model Summary. Table 9 shows the summary results for the hierarchical model in this study as described in Figure 2. Model 1 represents the first entry block in the model and refers to the control variables entered, Tuition and Fees, Endowment Beginning, Medical Degree, and Auxiliary Sales. The R Square (R^2) for Model 1 is .492, meaning that the control variables in this block explain or account for 49.2% of the variability in the dependent variable, Performance. The R^2 change of 49.2% is statistically significant for this model.

Model 2 refers to the independent variables entered in block two of the model and includes Percent Tenure-Tenure Track Faculty, Percent Admitted (Students), Patents Issued, and Community Engaged. These are the predictor variables of interest which form part of the research questions and hypothesis tested in this study. The R^2 for Model 2 is .699, meaning that the added variables improve the model and help explain or account for 69.9% of the variability in the dependent variable, Performance. The independent variables added to the model create a significant R^2 change of 20.7%.

Table 10					
<i>Coefficients^a</i>					
Model	Unstandardized Coefficients				
	B	Std. Error	t	Sig.	
1 (Constant)	-5969234.552	13263179.144	-.450	.653	
Tuition_Fees	.440	.052	8.421	.000	
Endow_Begin	.025	.003	10.023	.000	
Medical_Degree	143015767.886	16877358.760	8.474	.000	
Auxiliary_Sales	.453	.123	3.679	.000	
2 (Constant)	60212783.775	44947975.841	1.340	.181	
Tuition_Fees	.288	.044	6.599	.000	
Endow_Begin	.015	.002	6.716	.000	
Medical_Degree	172109429.968	14283944.105	12.049	.000	
Auxiliary_Sales	.354	.097	3.665	.000	
Percent_Tenure_Ttrack	-35760649.821	48509546.022	-.737	.461	
Percent_Admitted	-90104571.298	36303848.699	-2.482	.013	
Patents_Issued	3187565.544	178370.875	17.870	.000	
Comm_Engaged	-43143849.704	13580436.957	-3.177	.002	
Private_Public	-65814655.514	16593038.277	-3.966	.000	
a. Dependent Variable: Performance					

The independent variables, Percent Tenure-Tenure Track Faculty, Percent Admitted (Students), Patents Issued, and Community Engaged, explain or account for an additional 20.7% of the variability in Performance over and above any of the effects the control variables may have on the dependent variable, Performance. Overall, the

predictive power of the model is improved by the addition of the independent variables of interest.

Research Question and Related Hypotheses

This study seeks to further understand factors affecting institutional performance, as measured by grants and contracts revenue and licensing revenue, to seek empirical evidence of such factors, and to add to the literature by helping to develop more comprehensive models of university performance as well as to replicate and support previous findings in the literature. To this aim, this analysis seeks to answer the overarching question:

What are significant factors affecting institutional performance at high and very high research universities?

The hierarchical regression conducted as part of this study helps to answer this overarching question as well as the other underlying questions and related hypotheses presented in Chapter III. Table 10 presents the results of the model in terms of the variables involved, their related coefficients, and levels of significance. The results in this table help to address the relevant questions and hypotheses, which are further analyzed below by the topic of interest.

Tenure and Tenure Track Faculty

It was hypothesized in this study that universities with a larger number of tenured or tenure track faculty perform at a higher level than universities that have lower numbers of such faculty. Based on the results of the model, this hypothesis is *not supported* as the percentage of tenure and tenure track faculty is not statistically

significant. In addition the unstandardized beta coefficient is negative, suggesting that universities with a larger number of tenured or tenure track faculty would actually perform at a *lower* level than universities with lower numbers of tenured and tenure track faculty.

Student Selectivity

It was hypothesized in this study that universities that are more selective in terms of their students have a higher level of performance compared with universities that are less selective. Based on the results of the model, this hypothesis *is supported*, as the percentage of students admitted is statistically significant. The unstandardized beta coefficient is negative suggesting that the higher the percentage of students admitted, i.e., the less selective the institution, the *lower* the institutional performance.

Conversely, the more selective an institution, the lower the percentage of students admitted, the better off the performance level of the institution.

Private versus Public Status

It was hypothesized in this study that private (non-profit) universities by virtue of their status have a higher level of performance than public universities. Based on the results of the model, this hypothesis is *not supported*, because whether a university is public or private is statistically significant. The unstandardized beta coefficient is negative, suggesting that a private university by virtue of its status will have a negative impact on performance and therefore perform at a *lower* level than a public university.

Community Engagement

It was hypothesized in this study that universities classified as community engaged by the Carnegie Foundation for the Advancement of Teaching perform at a

higher level than universities not classified as community engaged. Based on the results of the model, this hypothesis is *not supported* because whether a university is classified as community engaged is statistically significant. The unstandardized beta coefficient is negative, suggesting that a university classified as community engaged will have a *lower* performance level than universities not classified as community engaged.

Patents Issued

It was hypothesized in this study that universities with higher patent application activity (patents issued/received) perform at a higher level than universities with lower patent activity. This hypothesis *is supported* because the number of patents received is statistically significant. The unstandardized beta coefficient is positive, suggesting that the more patents are issued and received by an institution, the *higher* the university performance.

Summary of Results

This study analyzed a sample of 207 universities classified as high and very high research universities under the 2010 Carnegie Basic classifications for the five-year reporting time period from 2008 to 2012. The data was analyzed to create a model of institutional performance using hierarchical multivariate regression. The variables were checked for multicollinearity and the analysis was used to answer the relevant research questions and associated hypotheses. Five hypotheses were tested and out of the five, two were supported and three were not supported. From the variables of interest, the percentage of tenure and tenure track faculty was found not to be statistically significant, while student selectivity, private versus public status, community engagement designation, and patents issued were found to be significant.

Chapter V provides a summary of the study and further interpretation of the data results in relation to the framework and literature discussed, policy, limitations of the study, conclusions, and recommendations for future research.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to explore and better understand factors affecting institutional performance, as measured by grants and contracts revenue and licensing revenue, to seek empirical evidence of such factors, to add to the literature by helping to develop more comprehensive models of university performance, and to attempt to replicate and support previous findings in the literature. This evidence may be used to inform institutional policy decisions as it relates to research and entrepreneurial activities and the role of universities as public policy agents of knowledge creation and dissemination. To this aim, this analysis sought to address the overarching question:

What are significant factors affecting institutional performance at high and very high research universities?

Related research questions and hypotheses were addressed and tested using hierarchical multivariate regression analysis using panel data collected from secondary data sources. This Chapter will present a summary of the study, will provide further interpretation of the data results in relation to the framework and literature reviewed, will discuss policy implications of the findings, will discuss limitations of the study, will

provide conclusions, and will recommend suggestions for future research in the topic area.

Summary of the Study

Table 11 summarizes the results of the study. Given the results of the analysis, of the five hypotheses tested, two were supported, two were not supported and one was not supported because the related variable was found not to be significant.

Table 11 <i>Hypothesis and Results of the Model</i>	
Hypothesis	Result
Alternative Hypothesis 1 (H_1): Universities with higher numbers of tenured or tenure track faculty perform at a higher level than universities with lower numbers	Not supported (Variable not significant)
Alternative Hypothesis 2 (H_1): Universities that are more selective in terms of their students have a higher level of performance compared with universities that are less selective	Supported (Variable significant)
Alternative Hypothesis 3 (H_1): Private universities by virtue of their status have a higher level of performance than public universities	Not supported (Variable significant)
Alternative Hypothesis 4 (H_1): Universities classified as “community engaged” by Carnegie Foundation perform at a higher level than universities not classified as “community engaged”	Not supported (Relationship in opposite direction; Variable significant)
Alternative Hypothesis 5 (H_1): Universities with higher patent application activity perform at a higher level than universities with lower patent activity	Supported (Variable significant)

Theoretical Framework

Given the results of this study, it is necessary to revisit the theoretical framework used to guide the study. The framework can provide a contextual understanding of the questions and hypotheses tested. A Postpositivist, deterministic worldview (Creswell,

2009), where ideas can be reduced to measurable variables that are empirically tested through hypotheses and research questions, guided this study along with theoretical perspectives provided by systems theory and neoliberalism.

Systems Theory

From a systems theory approach, it is easy to see how the findings in this study can be framed and guided by this approach given that the institutional inputs, factors, and variables, such as tenure and tenure track faculty, selectivity of students, entrepreneurial and engagement activities, and the status of an institution, can have an impact on the output of the institution or its performance. All the input variables and factors operate in and are affected by the higher education environment as well as policies and procedures at all levels including the institutional, local, state, and federal levels. Easton (1957) proposed systems theory as a way for understating complex political systems arguing that each part of the system does not stand alone but is related to each other part, and where this systemic approach is driven by inputs converted by the processes of the system into outputs, which in turn affect the environment and the system itself. Systems theory and the concept of inputs and outputs is used often in policy-making and analysis (Stewart & Ayres, 2001) and in assessing the economic impact of colleges and universities (Drucker & Goldstein, 2007).

Implications from the findings. Systems theory, the idea of inputs and outputs given processes and environmental factors, fits well as a framework for this study. It provides a way for looking at institutional inputs and thinking about how processes, policies and environmental factors may contribute to the outcome of the system. If for

example, given the results of this study, an institution classified as high and very high research is driven by environmental, political, policy, and practical factors to maximize institutional performance, the institution would strive for policies and actions to be highly selective of their students, to pursue entrepreneurial activities over community engaged activities and would necessarily benefit from being a public institution. Given a systems approach, the institution would look for the mix of input factors that would maximize the institutional performance, given environmental constraints and system processes. Systems theory provides a flexible framework with which to analyze and understand university performance given a complex higher education environment.

Neoliberalism Theory

The accompanying theoretical framework used in this study is neoliberalism theory. Neoliberalism theory can be used to understand forces acting on the higher education system and help frame some of the assumptions behind this study. Within the context of this study, neoliberalism can add an understanding of the many environmental, institutional and individual pressures acting upon and within the system. Neoliberalism is presented as a “theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade” (Harvey, 2005, p. 2). With respect to higher education institutions, these market forces can manifest in decreasing state and federal support for institutions, promotion of entrepreneurial and commercialization activities, increasing tuition rates, strategic faculty hiring, curriculum change and development, and increased competition for top students and institutional rankings

(Bok, 2003). University reputation is enhanced by successfully competing for talented graduate students and high profile faculty who can produce valuable research results, achieve stable grant support, help balance budgets, transfer and commercialize knowledge, and maintain institutional prestige (Gumport, 2011). The thirty institutions in the U.S. with the largest endowment levels are all research universities that engage in selective admission practices, bring in millions of federal and private research funds, reward faculty based on research activity, maintain large campuses, and offer specialized courses to highly capable students (Cohen & Kisker, 2010).

Implications from the findings. Neoliberalism theory provides an understanding of competitive pressures faced by higher education institutions engaged in a competitive market for resources and institutional inputs. This framework provided valuable assumptions that guided this study. Assumptions described and used in this study include the idea that - a competitive environment exists for students, faculty and funding, higher performance (higher revenues) is desired by institutions, high and very high research universities represent the top echelon of higher education institutions in the U.S., institutions seek to ascend in status, category, or rankings, community engagement activities can add prestige, and the number of new patents issued and received is used as a proxy measure for entrepreneurial activities. In addition, given this competitive framework, this study controlled for variables which can provide a competitive advantage, for example, tuition revenue, endowment support, auxiliary support, and the existence of a medical school and related activities. Given this neoliberal framework and the analysis in this study, the findings support this framework to the extent that an institution will seek to maximize performance (revenue) by being

highly selective of their students, would pursue entrepreneurial activities rather than community engaged activities and would necessarily benefit from being a public institution. Institutions would look for the mix of input factors that would maximize their performance given a competitive environment.

Given the results of the analysis however, this neoliberal framework does not fully explain why universities may engage in community engaged activities assuming competitive, revenue-driven, and self-maximizing forces are the main driver for institutional activities. The results of this study show a significant and negative relationship between community engagement activities and university performance yet many top research universities including urban, land-grant and private institutions continue to be involved in activities classified as community engaged (Hodges & Dubb, 2012; Trani & Holsworth, 2010). Given globalization, hyper-competition, and diminishing resources, perhaps neoliberalism theory can explain much of what has been occurring in higher education but other frameworks like social entrepreneurship (Agafonow, 2015; Driver, 2012; Santos, 2012) for example, may also help explain institutional activities that promote not only revenue and profits but also social responsibility and social impact.

Contribution to the Literature and Discussion of the Findings

As described in the literature section, universities are affected by policy decisions, and regardless of classification, are crucial agents of engagement, community and economic development. Given the deterministic worldview (Creswell, 2009) and the theoretical framework guiding this study, university classifications and activities can be reduced to measurable variables that can be empirically tested through

hypotheses and research questions that verify or refine ideas on how the world works. Following this logic, this study was conducted with the purpose of exploring and understanding factors affecting institutional performance, of providing empirical evidence of such factors, and of adding to the literature by helping to develop more comprehensive models of university performance as well as attempting to replicate and support previous findings in the literature.

As a contribution to the literature, this study adds another empirical input-output model for the analysis of university activities and for the study of high performing research universities. Consistent with other models in the literature (David, 2013; Leslie, Slaughter, Taylor & Zhang, 2012; Zhang and Ehrenberg, 2010) this study used panel data from national, secondary data sources to explore significant relationships among institutional variables. The following sections discuss the aspects of the study and study findings in relation to some of the models and other relevant issues discussed in the literature reviewed in Chapter II.

Performance and University Output

This study used grants and contracts revenue and licensing revenue as a (proxy) measure of institutional performance. Although this is a straightforward definition of performance, it would make sense that high and very high research universities would be concerned with maximizing their research revenue, as research is a main focus of their operation. Maximizing performance and research revenue would necessarily lead to greater investments back in the research enterprise of the institution to the benefit of the institution. This idea is supported by the literature in that the more grants and contracts revenue an institution has, the more will be spent on research - an additional

seventy-nine cents for every dollar of grants and contracts revenue at private research institutions, and an additional fifty cents for every dollar of grants and contracts revenue at public research institutions (Leslie, Slaughter, Taylor & Zhang, 2012). A second model in the literature uses a more complicated index as a measure of performance but the finding is similar in that there is a link between university performance and revenue and the share of that revenue devoted to research production (David, 2013). The implication is that factors that maximize performance or research revenue are desirable for an institution. A third model (Zhang & Ehrenberg, 2010) uses research and development expenditures as the output variable. A clear challenge in these analyses is developing a good measure of institutional output or performance. Although this study uses a straightforward measure of institutional performance, grants and contracts revenue and licensing revenue, it seems like a reasonable and adequate measure given this analysis.

Tenure and Tenure Track Faculty

Based on the results of the model in this study, the percentage of tenure and tenure track faculty is not statistically significant and is negatively correlated with performance. This finding contradicts some of the models in the literature, which suggest a positive relationship between full-time tenured or tenure track faculty and research expenditures (Zhang & Ehrenberg, 2010). A second model finds a significant positive relationship between professors and increases in the production of research and a negative relationship between assistant or associate professors and the production of research (David, 2013).

Perhaps to improve the significance of this variable in this study, the length of the analysis needs to be increased thereby increasing the numbers of cases analyzed in the panel. The study referenced in the literature, which suggests a positive relationship between full-time tenured or tenure track faculty and research expenditures, analyzed panel data over a fifteen-year period (Zhang & Ehrenberg, 2010) compared to a five-year period used in this analysis. Also, to improve the significance of this variable, faculty rank, such as professor, associate, assistant, can be added as a factor of analysis. Perhaps not all tenure and tenure track faculty are equally productive in terms of performance and differences exist by rank, age, and research productivity (Gitlow, Gitlow, Kurnow, & Oppenheim, 2011). In addition, performance may relate to the associated faculty discipline as well as personnel who may be non-tenure but are hired solely to produce grants and funded research. The negative correlation in this study may indicate that a more nuanced definition of the variable is warranted.

Student Selectivity

Based on the results of this study the percentage of students admitted is statistically significant. The higher the percentage of students admitted, i.e., the less selective the institution, the lower the institutional performance. Therefore, in a competitive environment, it benefits institutions to be highly selective of their students because it increases performance. This finding reinforces ideas from the literature that to the extent that institutions can attract greater resources, for example, highly selective students, institutions will seek to maximize performance by allocating resources accordingly, thereby increasing prestige and rankings, and reinforcing an institution's "mission differentiation" (Stocum, 2013, p. 11). This finding can extend also to the

recruitment of graduate students and the idea that increasing graduate students can have a positive effect on research expenditures (Zhang & Ehrenberg, 2010) and by association increase research revenues. An enhancement to this study would be to look at the number of doctoral degrees awarded and the correlation to university performance. This association, between doctoral degrees and performance, is an extension of the competition for students and is identified as a possible measure of university performance ("The Top American Research Universities," 2014). Within the context of this study, it is important to note, however, that for student selectivity the direction of causality, or whether institutional performance causes selectivity to increase or vice-versa, was not measured.

Private versus Public Status

Based on the results of this study whether a university is public or private is statistically significant. The results suggest that a private university by virtue of its status will have a negative impact on performance. This may be caused by the fact that private institutions receive little or no government appropriations that may bolster university operations or performance. This notion is supported by models in the literature (Leslie, Slaughter, Taylor & Zhang, 2012), which show that public universities, by virtue of their status, receive government appropriations and spend on average eleven cents on research for every dollar of appropriations received. Private research intuitions on the other hand, by virtue of their status, do not receive this source of revenue and therefore must make up revenues from other sources. Despite this finding, private universities seem to enjoy a higher level of prestige than do public institutions

with many public universities labeled as “wannabes,” striving for the same research status as private research universities (Stocum, 2013, p. 7).

Community Engagement

Based on the results of this study whether a university is classified as community engaged is statistically significant. The results of the analysis suggest that a university classified as community engaged will have a downward effect on performance levels compared to universities not classified as community engaged. The results would suggest that high performing research universities may not pursue community engaged efforts because it puts downward stress on performance and may not yield immediate benefits to the bottom line. This study result may provide evidence for ideas discussed in the literature that some larger, more complex and decentralized research universities have been slow in adopting these community engaged practices (Weerts & Sandman, 2010) and that acceptance may vary greatly by unit or discipline and may face resistance from faculty who have built successful careers and reputations on more “traditional forms of scholarship” (p. 633). In addition, this may provide some evidence that institutional impediments to community engaged activities exist at high and very high research universities because of the pressures to “reproduce researchers” and the “drive for institutional prestige” (Hutcheson, 2007, p. 113). Another impediment may be promotion and tenure policies that do not recognize, value or reward faculty service or engagement efforts. In this case, faculty do not have the incentive to carry out engagement activities. Wade and Demb (2009) identified factors that may affect the likelihood of faculty taking part in service or engagement activities, key among these are tenure and hiring procedures and integration of engagement into mission and

resources. In addition, community-based research, which is of great importance, may, however, often be of smaller scale or pro-bono in nature and may measure negatively in the type of analysis presented in this study

This factor warrants additional investigation, because despite this result the literature shows many top research universities including urban, land-grant and private institutions continue to be involved in activities classified as community engaged (Hodges & Dubb, 2012; Trani & Holsworth, 2010). In addition, the data analyzed for 2012 for this study for example, shows that approximately 45% (49/108) of very high research universities engaged in community based work and are designated as community engaged. The Community Engagement classification, as discussed before and unlike the Carnegie Basic Classifications, is a self-reporting classification whereby institutions desiring this label provide evidence of related activities to the Carnegie Foundation designees who then confer the designation. Some high performing HEIs, who are engaged in related activities, may not take the time or effort to self-report and apply for the designation despite their activities. Therefore, this is a complex variable difficult to define and may not fully reflect all of the institutions involved in these activities.

Patents Issued

Based on the results of this study, the number of patents issued is statistically significant with an implication that the more patents that are issued and received by an institution, the higher the entrepreneurial activities of the university, and the higher the institutional performance is likely to be. This supports the idea described in the literature that universities have taken a dramatic entrepreneurial turn in the last 10-15

years as evidenced by the “proliferation and enlargement of technology transfer offices, the increase in the number of invention disclosures, patents and licenses, changes in universities’ mission statements, and changes in tenure and promotion criteria” (Goldstein, 2010, p. 84). This study result may also provide evidence that faced with decreasing resources, institutions may act in entrepreneurial ways to gain additional sources of revenue, to gain a competitive edge and to operate in a self-sustaining way. This result also supports the idea that university based entrepreneurial activities can have a significant economic impact not just for the institution but also for society at large (Roessner, Bond, Okubo, & Planting, 2013). Roessner et al., estimate that the impact of these activities to gross domestic product ranged from \$10 billion to \$22 billion (in 2005 dollars) in 2010 alone (p. 31). The fact that patents are included in this analysis is supported by the literature as an important institutional activity but contradicts David’s (2013) model, which does not include patents as an element of top-level academic research (p. 85).

Policy Implications of the Findings

To the extent that high and very high research universities continue to face a competitive environment with decreasing state and federal resources, the results of this study would imply that universities will continue to pursue strategies, policies and practices that maximize institutional revenues and performance in order to ensure they remain competitive while at the same time remain accountable and responsive to stakeholders’ concerns. Greater understanding of institutional factors that can impact revenues will become important as competition for revenues increase. Performance models such as the one explored in this study can help universities, policy makers, and

stakeholders make decisions and set policies that can bolster the institutions' activities given environmental challenges.

Competition for Resources

One policy implication is that regardless of the status of an institution, whether private or public, high and very high research universities will increasingly continue to pursue and compete for the same sources of revenue to the extent that the distinction between public and private universities may become more narrow in the future. If the trend of decreasing state support continues, public research universities will continue to develop and pursue non-governmental sources of revenue - increasing tuition, endowments and gifts, and research grants, much like private universities already do (Gitlow, Gitlow, Kurnow, & Oppenheim, 2011). Some public universities for example, have begun efforts to gain greater autonomy from state leaders in making decisions and setting policies on diverse issues such as tuition rates, procurement, and capital projects (Lewin, 2011). Private institutions likewise pursue and receive comparable research and development support from the federal government, actually receiving more in 2012 than public institutions. In fiscal year 2012, the federal government provided seventy percent of the science and engineering research and development funds spent by private institutions while it provided sixty percent of the funds spent by public institutions. In addition, this research and development activity is concentrated in a relatively small number of institutions with the top-spending one hundred institutions accounting for nearly eighty percent of all research and development spending (National Science Foundation, 2014b). Institutions are likely also to continue to compete for highly qualified students as well. Institutions both private and public will continue to

adapt and enact policies that will attract students to their universities at the expense of the competition. Some public institutions for example, which may have traditionally educated and attracted in-state, local students, are changing policies to be able to attract and retain top students from out-of-state (Anderson & Douglas-Gabriel, 2016). These changes in policy not only maximize tuition for the public institution but also put them in direct competition with private universities who may have existing student populations made up of predominantly out-of-state students. This competitive trend is likely to continue making performance models such as the one explored in this study more relevant for decision makers.

Institutional Agenda Setting

Another policy implication is that institutional actions and policies will be driven by priorities set by these high and very high research universities given the competitive environment and other forces acting within the higher education system. To the extent that maximizing performance is a priority for institutional leaders, this issue would move along the relevant agenda levels to become an important part of not only the institutional agenda but also the decision agenda on which action is ultimately taken (Birkland, 2005). If given the results of this study, maximizing institutional performance is on the decision agenda, institutional leaders will enact policies that attract highly selective students and increase entrepreneurial activities while enacting policies that minimize engagement activities that do not add to the performance of the institution. Community engagement activities can still be on the institutional agenda, meaning they are important to the institution and up for consideration but may not make it to the decision agenda where action is ultimately taken. This may be the case for many high

and very high research universities where community engagement is on the institutional agenda but may not get to the action or implementation stage because of other competing decisions and priorities pushed by decision makers. A recent example of this agenda shift was exemplified at a major research university when the subject of tenure and the ability for leaders to make employment decisions and academic program

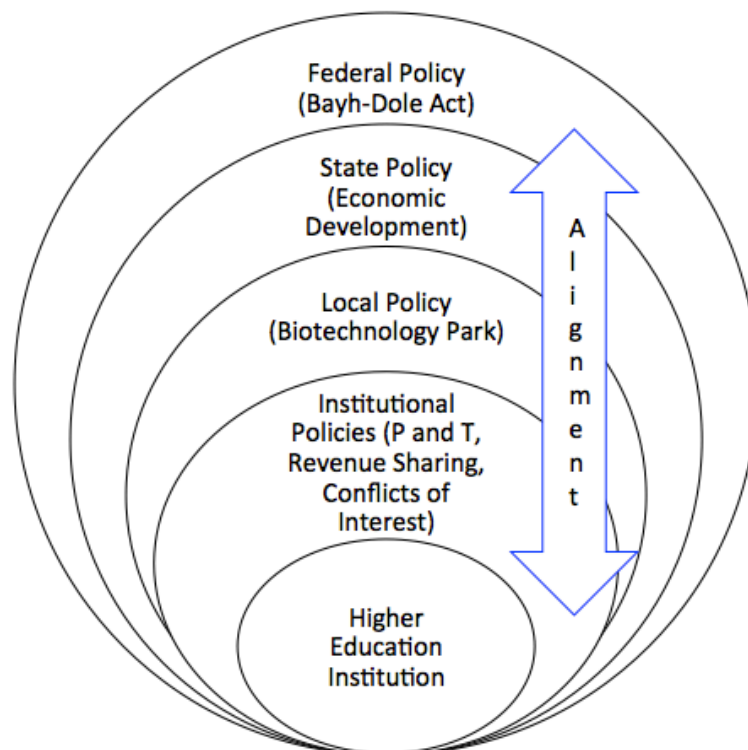


Figure 3. Policy Alignment – Entrepreneurial Activities at H.E. Institutions

decisions based on financial considerations moved from the institutional agenda to the action agenda despite widespread apprehension (Savidge, 2016).

Policy Alignment

To the extent that institutions want to maximize revenues

and performance in order to ensure they remain competitive, another policy implication is that institutions can use policies as extrinsic motivators to arrive at strategic goals. Policies can be aligned at different levels to ensure institutional activities will have the best chance to succeed and activities will result in positive gains to the institution. In some ways this has already occurred and continues to occur as institutions continue down their entrepreneurial turn by aligning institutional policies, such as tenure and

promotion, mission statements, the growth of technology transfer offices, and promoting the increase of invention disclosures, and patents and licenses (Goldstein, 2010, p. 89), with local, state and national policies. The Bayh-Dole Act of 1980 encouraged universities as well individual academics to explore and foster relationships, activities, and varying arrangements such as research parks, incubator facilities, and technology transfer offices that promote commercial activities and economic development (Etzkowitz, 2002). Figure 3 shows a depiction of the concept of policy alignment as it pertains to entrepreneurial activities at higher education institutions. Policies are adopted at each level which complement and support other levels as well as incentivize desired outcomes at the institutional level. This concept has implications and can be adapted for other desired outcomes such attracting and selecting top students or other priority items on the institutional and decision agendas.

Limitations of the Study

This study is limited by several factors, mainly, the use of secondary data on U.S. universities only, the limited time frame of five-years, and the difficulties in defining what constitutes institutional performance. These limitations are further discussed below.

This study used a non-experimental quantitative research design using secondary analysis of data collected through the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), the Association of University Technology Managers (AUTM), the Carnegie Foundation for the Advancement of Teaching. Panel data was analyzed on high and very high research universities in the U.S. and as defined by the Carnegie Foundation. This study examined U.S. institutions only, Carnegie classified under the 2010 Basic Classification

as high and very high research for public and private non-profit institutions, for the five-year time period from 2008 to 2012.

As such this study is limited by secondary data analysis because the data was collected for a purpose other than answering the research questions posed in this study and therefore can only approximate the data that otherwise would have been directly collected to answer these questions (Frankfort-Nachmias & Nachmias, 2008). Because of this limitation, the secondary data is used as proxy measures for the concepts and values of variables such as performance, entrepreneurial and engagement activities, and student selectivity. The time frame of the study is also a limitation because larger samples or cases may improve the significance of variables and relationships analyzed in the study.

Another limitation of the study is trying to accurately define a dependent variable for institutional performance. This is again an inherent problem is using secondary data because proxy measures have to be developed to approximate the desired values and concepts in question. As used in this study, performance is defined as grants and contracts revenue and licensing revenue. Given other definitions presented in the literature, the definition used in this study is not unreasonable especially with the research focus present at high and very high research universities. This performance model is limited also in that it does not encompass all of the relevant institutional activities that may impact performance.

Likewise, a limitation exists in measuring and defining the community engaged variable, which as discussed, is a self-reporting classification and therefore does not capture completely all of the institutions involved in such work. Some high performing

research universities may not take the time or effort to self-report and apply for the designation despite their varied engagement activities. This limits the explanatory power of this variable because worthy institutions may be absent from this classification.

Finally, a limitation exists in the Tenure and Tenure-track Faculty variable. The variable as used in this study does not distinguish among fields or disciplines of study, which may or may not be more productive in terms of research and research related activities. Some disciplines in the humanities and sciences, for example, have not been historically engaged in high-level funded research. In addition, this variable does not distinguish or address the fact that non-tenure track faculty are hired for the express purpose of conducting research and producing grants that bring in significant research revenues to high and very high research institutions. An associated limitation is that this study does not include and does not account for post-doctoral personnel who are heavily engaged in grant funded research activities and who support and bolster the performance of high achieving institutions.

Recommendations

Based on the conduct of this study, it is clear there is a great need for accurate, timely and comprehensive data to inform decision and policy making, and there is also a great need to define and understand factors that impact university activities and performance at all levels and functions of the higher education spectrum, especially at high and very high research universities. As such two overarching recommendations are for leaders, stakeholders, and policy makers to advocate for the collection of accurate, timely and widely available data and to make concerted efforts to better define, understand and support factors that help higher education institutions succeed.

These recommendations are further discussed below.

Need for Accurate, Comprehensive Data

Because higher education institutions continue to face conflicting demands and must compete for revenue sources, become more self-sustaining, while at the same time remain accountable to stakeholders and answer questions about their role and value to society, access to reliable data is crucial and must be improved in order to be able to make sound decisions and to enact effective policies with lasting impact. This study relied mainly on data available through the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS). Under the Higher Education Act of 1965 and its amendments, institutions that receive and participate in the federal student financial aid program must report annual data on enrollment, graduation rates, faculty and staff, finances and other key institutional data ("About IPEDS," 2016). Although not perfect, IPEDS is a widely used source of information on postsecondary institutions in the United States. Despite its wide use, IPEDS does not collect all relevant data on institutional activities. For example, data on community driven activities or pedagogies are not collected in the IPEDS surveys. Data on community partnerships, number of service hours students spend in the community, or number of courses that contain a service-learning focus, all relevant activities for some institutions, are not captured by the IPEDS surveys. The IPEDS data can be improved by adding these and associated parameters to the data collected. A recommendation for policy makers and stakeholders is to advocate for the expansion of the data collected by IPEDS to better inform data analysis and decision-making of postsecondary institutions.

This study also relied on data collected and reported by the Association of University Technology Managers (AUTM). AUTM is a non-profit organization that promotes the profession and activities related to technology transfer at universities and institutions (“About AUTM,” 2016). AUTM collects technology transfer related data, such as patents, licensing income, start-ups, etc., from member institutions and partners on an annual basis. Unlike IPEDS data collection, which is mandated by legislation, AUTM data collection is based on an annual survey sent to member participants. This method of collection is not as comprehensive as IPEDS data collection. A recommendation for policy makers and stakeholders is to incorporate and expand the data collected by IPEDS to include the technology transfer data now collected by AUTM. Although not perfect, IPEDS is better suited as a central repository for data related to activities performed by postsecondary institutions in the U.S. IPEDS should be enhanced as a data collection tool to encompass other areas of university activities including entrepreneurial activities as well as community driven engagement activities.

Need to Understand University Factors

In addition to the need for comprehensive and accurate data, there is also a great need to define and understand factors that impact university activities and performance at all functions and levels of the higher education spectrum. High and very high research universities represent the upper echelon of these educational institutions and therefore represent a unique case. As high and very high research universities, these institutions are particularly faced with challenges given that they have to not only focus on the research enterprise but also on teaching and service. Leaders and policy makers should make concerted efforts to clearly define and understand factors that

make these institutions succeed. This study along with other models from the literature is a start to be able to understand institutional factors and university activities. This study defined performance as grants and contracts and licensing revenue and identified significant institutional factors such as entrepreneurial activities and student selectivity as positive contributors to performance while the status of the institution and community engaged activities were identified as negative contributors to this particular definition of performance. More empirical models of university activities are recommended so that a better understanding of these factors will be established over time. The following section provides concluding statements as well as more ideas for future research in this area.

Conclusions and Future Research

There is clear evidence and ample cases to support the idea that universities are indispensable in society, are key agents of community, social and economic development (Trani & Holsworth, 2010) and can serve as anchors, conveners, facilitators and leaders in their environment (Hodges & Dubb, 2012). Some of these institutions are deeply bound by place and unlike a business that can more easily uproot or move, universities must adapt to changing times and weather physical and symbolic hurricanes in service to their communities (Cowen & Seifter, 2014; Pope, 2010). These vital institutions however are under stress as conflicting societal, political and institutional demands continue to shape their operation. Under stress, these higher education institutions (HEIs) must compete for revenue sources, become more self-sustaining, and must maximize outputs, while at the same time answer questions about their role and value to society. As resources become constrained, the need to

understand the relationship between institutional factors and institutional output or performance increases.

As a way to understand these factors, this study explored factors affecting institutional performance, as measured by grants and contracts revenue and licensing revenue, to seek empirical evidence of such factors, and to add to the literature by helping to develop more comprehensive models of university performance as well as to replicate and support previous findings in the literature. The development of comprehensive models of institutional performance can assist stakeholders, policy makers, and leaders, in informed decision-making, policy development, and resource allocation given economic constraints. As part of the study hypotheses were tested and institutional factors such as student selectivity, patents or entrepreneurial activities, community engagement and public versus private status were found s to be significant. The first two items, student selectivity and patents or entrepreneurial activities, had a positive effect on performance while the last two items, community engagement and public versus private status, had a negative effect on performance. Despite the findings of this study, more empirical models of university activities are recommended so that a better and more comprehensive understanding of institutional factors will be established over time. The following section describes areas for further research and possible investigation given this topic of discussion.

Suggestions for Future Research

For reasons described earlier, understanding institutional factors and developing empirical performance models is important enough to continue to develop as an area of inquiry. Given the analysis presented in this study, there a number of related areas or

projects that warrant future investigation and research.

Extension of this study. As an extension or continuation of this study, a similar study should be conducted adding more years to the panel analysis and using the same variables. The study described in this paper spanned the years 2008-2012. IPEDS and AUTM now include additional years that can be added to the analysis. This would add cases to the model and may make some of the variables change significance or add predictive power to the model. In addition, future research can either use the 2010 Basic Carnegie Classifications used in this study or recode to the new updated 2015 Carnegie Classifications (“Carnegie Classifications,” 2016). An extension of this study would also allow an opportunity to replicate or confirm findings.

Extension of this study using new framework. As a continuation of this study, a similar study could be conducted adding more years to the panel analysis and using the same variables, but with a new framework for analysis to more fully incorporate community driven work taking place at high and very high universities. As stated before, neoliberalism theory may not fully explain why competition driven institutions may engage in community driven work. Other frameworks, like social entrepreneurship (Agafonow, 2015; Driver, 2012; Santos, 2012), or other frameworks may better explain institutional activities that promote not only revenue and profits but also social responsibility and social impact.

New study using some control variables as predictor variables. A new, similar model could be tested using institutional endowment and/or the existence of a medical school as a predictor variable, keeping other variables the same. The current study controlled for known important institutional variables such as endowment and the

existence of a medical school to get to other significant variables affecting performance. It would be expected that adding these as predictors rather than control variables would have a significant effect on performance as well as other variables. Endowment gifts for example may have a positive effect on the creation of university-based centers, which may then engage in community impact work. The Netter Center at University of Pennsylvania (Harkavy & Hartley, 2012) for example was endowed through a donor gift.

New study using urban serving institutions. A new model could be developed and tested focusing on universities located in an urban setting, keeping other variables the same. This model would test if location of the high and very high research university would have an effect on performance or other variables. Universities located in urban centers may have a particular set of diverse circumstances, relationships and stakeholders to deal with then universities not located in urban centers (Perry & Wiewel, 2005).

New study with new definition of performance, and new framework. A totally new model could be developed conceptualizing a new definition of institutional performance as well as new institutional variables. A new empirical model could be developed for example using the parameters set out by the Center for Measuring University Performance (MUP) parameters and a new theoretical framework. The MUP looks at nine indicators of university activity and output including total research and development expenditures, federally sponsored research and development expenditures, number of members of the National Academies among an institution's faculty, number of significant faculty awards earned as indicators of faculty distinction, doctorates awarded, number of postdoctoral appointments supported, median SAT

scores, endowments, and annual giving (“The Top American Research Universities,” 2014). In addition, a better variable definition for the community engagement designation could be developed to include in the new model. Redefining the community engagement variable would allow the capture of active institutions that do not self-report their engagement activities and who do not apply for the engagement classification. A better definition of the faculty variable could also be explored by either taking into account various ranks of faculty (professor, assistant, associate, etc.) or by taking into account the function of the personnel to distinguish from teaching versus research faculty who may serve specific functions within an institution. These different functions may impact performance in unique ways.

The above suggestions are only a few possibilities for continuing this line of inquiry to try to find empirical evidence and to determine, verify and support institutional factors, which may have an influence on performance.

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Curriculum Vitae

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Education

- 1991 Louisiana State University, Baton Rouge, LA
B.S. in Business Administration and Finance
- 1992 University of New Orleans Summer School Program
July-August Innsbruck, Austria
Course work in Business and German
- 1998 Tulane University, New Orleans, LA
M.B.A in Finance and Administration
- 2016 Virginia Commonwealth University, Richmond, VA
Ph.D., Public Policy and Administration
Dissertation Title: *Factors affecting institutional performance at high and very high research universities: Policy implications*

Positions and Employment

- 1997-2001 Accountant II-III, Department of Medicine, Tulane University, New Orleans
- 2001-2004 Section Administrator, Department of Medicine, Tulane University
- 2005-2007 Senior Section Administrator, Department of Medicine, Tulane University
- 2007-2012 Senior Administrator, Office of Research, Virginia Commonwealth University, Richmond
- 2012- Research Coordinator, School of Education, Virginia Commonwealth University

Other Experience and Leadership

- 2009 Graduate Teacher Assistant, PADM625-Public Policy Analysis, VCU
- 2009-2010 President-elect, Society of Research Administrators-Virginia Chapter
- 2010-2011 President, VCU Staff Senate
- 2010-2011 President, Society of Research Administrators-Virginia Chapter
- 2011-2012 Vice-President, VCU Staff Senate (special appointment)
- 2012- President, Pi Alpha Alpha, VCU Chapter, National Honor Society for Public Affairs and Administration
- 2014 Graduate, VCU Grace E. Harris Leadership Institute, Leadership Development Program

Professional Memberships

- 2007- Society of Research Administrators International (SRA International)
- 2009- Association for Public Policy Analysis and Management (APPAM)
- 2014- American Society for Public Administration (ASPA)

Honors

- 2004 Tulane University Staff Excellence Award
- 2008- Designation, Certified Research Administrator, Research Administrators Certification Council

2009 Virginia Commonwealth University Pride Ambassador Award Nominee
2010- Member, Pi Alpha Alpha, National Honor Society for Public Affairs and Administration

Publications

Alcaine, J.G. (2009) *Research Administration in the Electronic Age: Public Policy Concepts*. Symposium paper included in the proceedings of the 2009 SRA International Symposium, Seattle, Washington, October 17-21, 2009.

Alcaine, J.G., Ballance, L., Robb, S. & Ward, J. (2009) *A Case Study: Implementing an ERA System and Culture of Change*. Symposium paper included in the proceedings of the 2009 SRA International Symposium, Seattle, Washington, October 17-21, 2009.

Abstracts

Alcaine, J.G. (2009). *Policy Incubators: Universities as Public Policy Agents*. Presented as part of the 8th Annual Graduate Research Symposium, The College of William and Mary, Williamsburg, Virginia, March 27-28, 2009.

Alcaine, J.G. (2010). *Government Funding of University-based Community Projects: How Effective is this Policy?* Presented as part of the Wilder School Research Series, Virginia Commonwealth University, Richmond, Virginia, February 3, 2010.

Alcaine, J.G. (2010). *In the Neighborhood: Universities, Community Engagement and Development*. Presented as part of the 9th Annual Graduate Research Symposium, The College of William and Mary, Williamsburg, Virginia, March 26-27, 2010.

Lectures

"Show me the Money: Working with OSP and Budgeting," Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, February 4, 2009

"Budgeting for Grant Submissions," Lecture for Biostatistics 610 students, VCU Tompkins-McCaw Library, March 16, 2009

"Electronic Proposal Preparation and Submission at VCU," Lecture for Allied Health Professions Ph.D. Students, Tompkins-McCaw Library, June 26, 2009

"Show me the Money: Working with OSP and Budgeting," Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, March 18, 2010

"Budgeting for Grant Submissions," Lecture for Biostatistics 610 students, VCU Tompkins-McCaw Library, March 24, 2010

"Electronic Proposal Preparation and Submission at VCU," Lecture for Allied Health Professions Ph.D. Students, VCU West Hospital, Room 1-310, June 25, 2010

"Show me the Money: Working with OSP and Budgeting," Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, March 15, 2011

- "Electronic Proposal Preparation and Submission at VCU," Lecture for Allied Health Professions Ph.D. Students, VCU West Hospital, Room 1-310, June 26, 2011
- "Show me the Money: Working with OSP and Budgeting," Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, February 23, 2012
- "Research Administration Basics and Working with OSP," Center for Clinical and Translational Research Community Engagement Core Academy Lecture, Department of Social & Behavioral Health, March 21, 2012
- "Electronic Proposal Preparation and Submission at VCU," Lecture for Allied Health Professions Ph.D. Students, VCU West Hospital, Room 1-310, June 25, 2012
- "Budgeting for Grant Submissions," Lecture for CCTR 691 Special Topics course "Grant writing for Translational Research" students, VCU Grant House, June 26, 2012
- "Electronic Proposal Preparation and Submission at VCU," Lecture for Grant Writing Class, PSYC-700 Ph.D. Students, VCU Hibbs Hall, August 31, 2012
- "Show me the Money: Working with OSP and Budgeting," Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, February 13, 2013
- "Managing the Money," Research Incubator Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, April 24, 2014
- "Finding Research Funding," Lecture for Public Policy 780 students, VCU Starke House, November 11, 2014
- "Managing the Money," Research Incubator Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, April 24, 2014
- "Managing the Money," Research Incubator Lunch Series Lecture, sponsored by VCU Center for Clinical and Translational Research and Tompkins-McCaw Library, February 11, 2015
- "Reaching Every Student," Fellows Presentation, VCU Institute on Inclusive Teaching, May 18, 2015
- "Establishing a Community of Practice to Facilitate Research Administration," Co-Presenter at the Society of Research Administrators Virginia Chapter Meeting, UVA, May 20, 2015
- "Proposal Preparation, Submission, and Management at VCU," Lecture for Allied Health Professions Ph.D. Students, ALHP 716, VCU West Hospital, Room 1-113, June 22, 2015

Teaching and Research Development Activities

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| 2008 | Attendee, VCU Center for Teaching Excellence, Teaching and Learning with Technology Institute, June 2-6 |
| 2010 | Attendee, VCU Center for Teaching Excellence, Summer Institute on Teaching and Learning, May 17-21 |

2012	Attendee, VCU Center for Teaching Excellence, Summer Institute on Inclusive Teaching and Learning, June 18-22
2013	Participant, VCU Community Engaged Research Mini Institute Conference, May 2-3
2014	Advisory Committee Member, VCU Center for Teaching Excellence, Summer Institute on Inclusive Teaching, May 19-23

Service Activities

2008-2012	Member, Virginia Biotechnology Park Communications Committee
2009-2013	Member, VCU Council for Community Engagement
2009-	Member, VCU University Council
2009-2012	Senator, VCU Staff Senate
2010-2011	Member, VCU Recalibration Working Group, Theme IV, Community Engagement
2010-2012	Member, VCU Ad-hoc Committee to Review University Council Bylaws
2010-2011	Member, VCU Search Committee for Provost and Vice-President for Academic Affairs
2011	Member, VCU Presidential Inauguration Advisory Committee
2011-2012	Member, VCU Search Committee for Vice-President for Diversity and Equity
2011-2012	Staff Representative, VCU Board of Visitors
2011-2012	Member, VCU Electronic Communications Modernization Project
2012-	Member, VCU Quest Strategic Plan Steering Committee
2012-	Member, VCU Email Project and Steering Committee
2012-	Member, VCU School of Ed., Research and Professional Development Committee
2013	Member, VCU School of Ed., Search Committee for Graduate Studies Staff Position
2013	Member, VCU School of Ed., Search Committee for Associate Dean for Research and Professional Development
2013-	Senator-Alternate, School of Education, VCU Faculty Senate
2015-	Council Member, ASPA VCU Chapter
2016	Member, VCU School of Ed., Search Committee for Student Services Staff Positions

Mentorship Activities

2010	VCU Discovery Dialogues Program; Mentor to Alison Montpetit, Ph.D., Presenting, "Discovering Lung Infection Early: Could your Breath be the Key?" December 13, 2010
2011	VCU Discovery Dialogues Program; Mentor to Nadia German, Ph.D., Presenting, "Discovering a New Potential Treatment for Alzheimer's," February 14, 2011
2011	VCU Discovery Dialogues Program; Mentor to Katherine Sayers, Ph.D., Presenting, "This is Your Epileptic Brain on Marijuana...Discovering Links between Cannabinoids and Excitability," May 9, 2011
2011	VCU Discovery Dialogues Program; Mentor to Ben Van Tassell, PharmD., Presenting, "Discovery of Interleukin-1 Blockade as a Therapy for Heart Failure," September 12, 2011
2012	VCU Discovery Dialogues Program; Mentor to Melanie Bean, Ph.D., Presenting, "Yes, but...Addressing ambivalence about participation in pediatric obesity treatment," December 10, 2012
2013	VCU Discovery Dialogues Program; Mentor to April Kimmel, Ph.D., Presenting, "Discovering the impact of expanded HIV treatment availability in developing countries: the example of Haiti," October 14, 2013
2015	VCU Discovery Dialogues Program; Mentor to April Kimmel, Ph.D., Presenting, "Discovering the impact of expanded HIV treatment availability in developing countries: the example of Haiti," October 14, 2013

Volunteer and Community Work

2000-2004 United Way Campaign Volunteer, Tulane
2003-2005 American Heart Walk, Team Organizer, Tulane
2003-2005 Tulane University Paint Rally for New Orleans Public Schools
2006-2007 Volunteer Soccer Coach, Lakeview Youth Soccer, New Orleans
2008-2011 Volunteer Soccer Coach, Westhampton Community Center, Richmond
2011-2015 Volunteer Soccer Coach, Tuckahoe YMCA, Richmond
2015-2016 Volunteer Soccer Coach and Founding Member, St. Bridget School Soccer Program